US005602963A

United States Patent [19]

Bissonnette et al.

[11] **Patent Number: 5,602,963**

[45] **Date f Patent: Feb. 11, 1997**

[54] **VOICE ACTIVATED PERSONAL ORGANIZER**

[75] Inventors: **W. Michael Bissonnette**, North Hills; **Douglas L. Turner**, Thousand Oaks; **Mark P. Fortunato**, Reseda, all of Calif.

[73] Assignee: **Voice Powered Technology International, Inc.**, Canoga Park, Calif.

[21] Appl. No.: **134,327**

[22] Filed: **Oct. 12, 1993**

[51] **Int. Cl.**[6] **G10L 5/00**

[52] **U.S. Cl.** **395/2.84**; 395/2.83

[58] **Field of Search** 395/2.79, 2.83, 395/2.84, 2.53, 600; 381/41–43; 364/709.11, 709.12

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,117,542	9/1978	Klausner et al.	364/705.05
4,228,470	10/1980	Rahamin et al.	360/12
4,302,752	11/1981	Weitzler	340/309.15
4,391,530	7/1983	Wakabayashi et al.	368/63
4,573,187	2/1986	Bui et al.	395/2.84
4,644,107	2/1987	Clowes et al.	379/354
4,829,577	5/1989	Kuroda et al.	395/2.53
4,864,622	9/1989	Iida et al.	395/2.55
4,882,685	11/1989	van der Lely	364/709.11
4,928,302	5/1990	Kaneuchi et al.	379/88
5,007,081	4/1991	Schmuckal et al.	379/354
5,014,317	5/1991	Kita et al.	395/2.83
5,020,107	5/1991	Rohani et al.	395/2.84
5,237,651	8/1993	Randall	395/148
5,335,276	8/1994	Thompson et al.	395/2.84

OTHER PUBLICATIONS

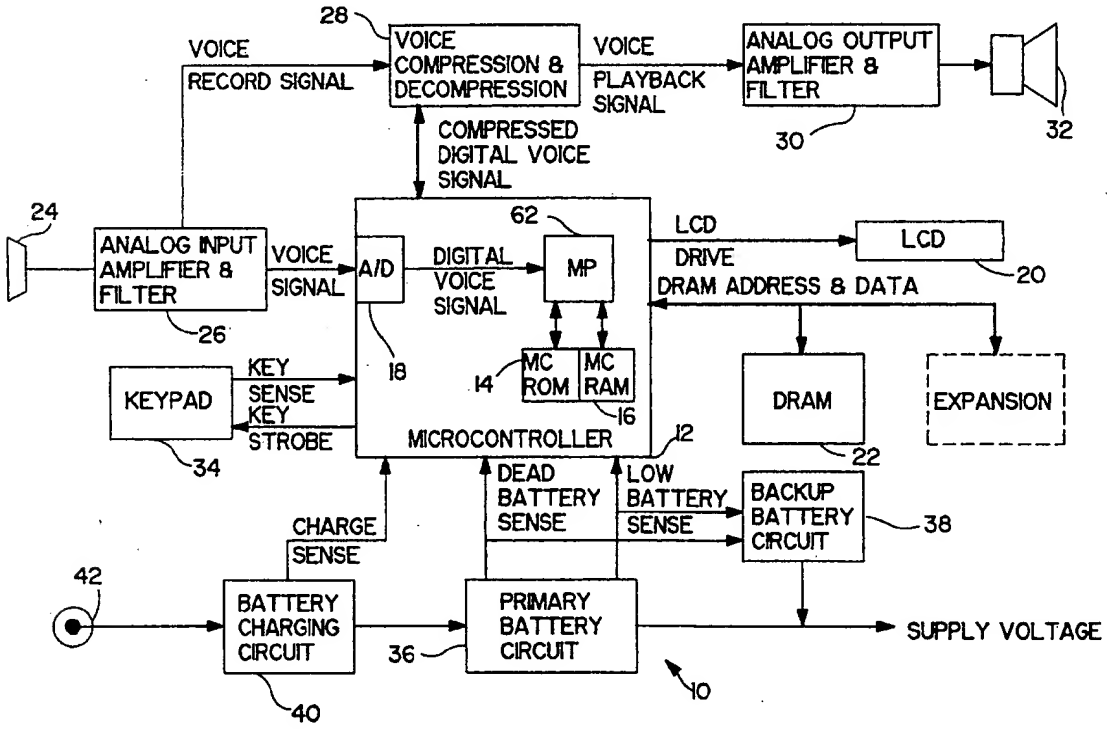
Lu, "A Small Revelation", Macworld, Sep. 1993, pp. 102–106.

Primary Examiner—David D. Knepper
Attorney, Agent, or Firm—Loeb & Loeb LLP

[57] **ABSTRACT**

A small, portable, hand-held electronic personal organizer performs voice recognition on words spoken by a user to input data into the organizer and records voice messages from the user. The spoken words and the voice messages are input via a microphone. The voice messages are compressed before being converted into digital signals for storage. The stored digital voice messages are reconverted into analog signals and then expanded for reproduction using a speaker. The organizer is capable of a number of a different functions, including voice training, memo record, reminder, manual reminder, timer setting, message review, waiting message, calendar, phone group select, number retrieval, add phone number, security, and "no" logic. During such various functions, data is principally entered by voice and occasionally through use of a limited keypad, and voice recordings are made and played back as appropriate. A visual display provides feedback to the user. During the various function, the user can edit various different data within the organizer by eliminating or correcting such data or entering new data.

6 Claims, 19 Drawing Sheets



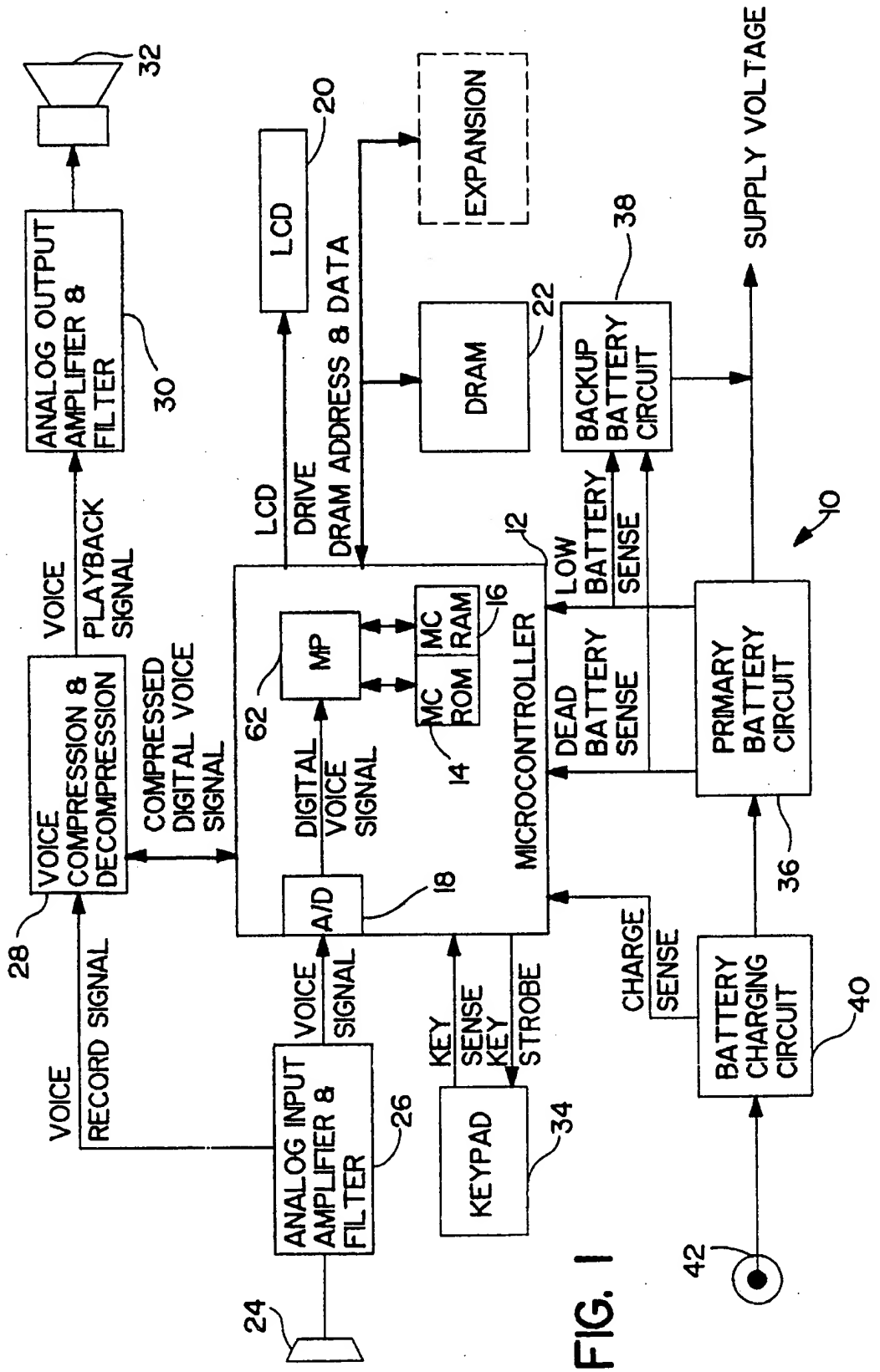

32
ANALOG OUTPUT AMPLIFIER & FILTER
30
VOICE PLAYBACK SIGNAL
VOICE COMPRESSION & DECOMPRESSION
28
COMPRESSED DIGITAL VOICE SIGNAL
VOICE RECORD SIGNAL
ANALOG INPUT AMPLIFIER & FILTER
26
24
VOICE SIGNAL
LCD
20
LCD DRIVE
DRAM ADDRESS & DATA
EXPANSION
DRAM
22
MP
62
MC RAM
16
MC ROM
14
DIGITAL VOICE SIGNAL
A/D
18
MICROCONTROLLER
12
KEY SENSE
KEY STROBE
KEYPAD
34
BACKUP BATTERY CIRCUIT
38
LOW BATTERY SENSE
DEAD BATTERY SENSE
PRIMARY BATTERY CIRCUIT
36
CHARGE SENSE
BATTERY CHARGING CIRCUIT
40
42
SUPPLY VOLTAGE
10

FIG. 1

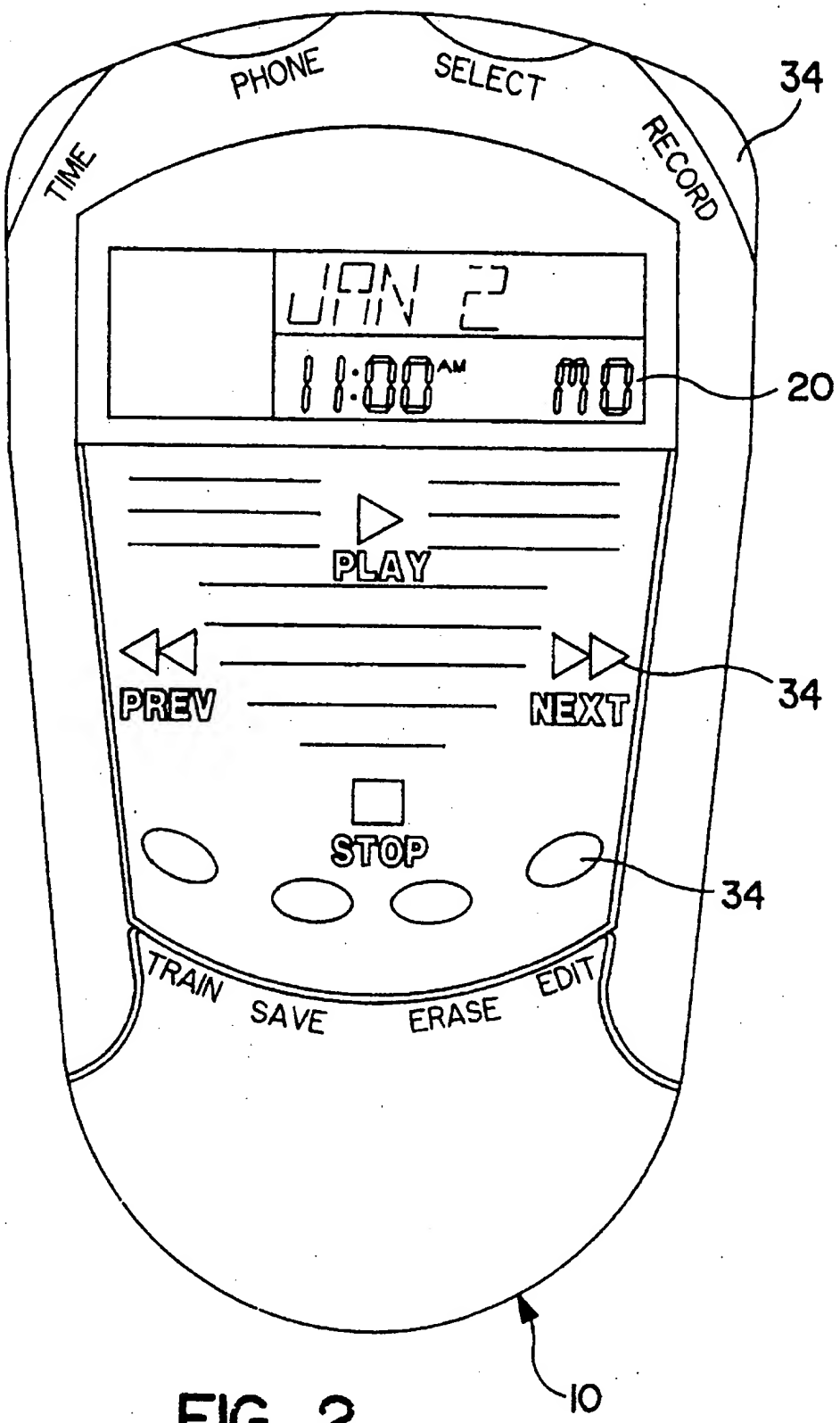

PHONE
SELECT
TIME
RECORD
34
JAN 2
11:00 AM
M0
20
PLAY
PREV
NEXT
34
STOP
34
TRAIN
SAVE
ERASE
EDIT
10

FIG. 2

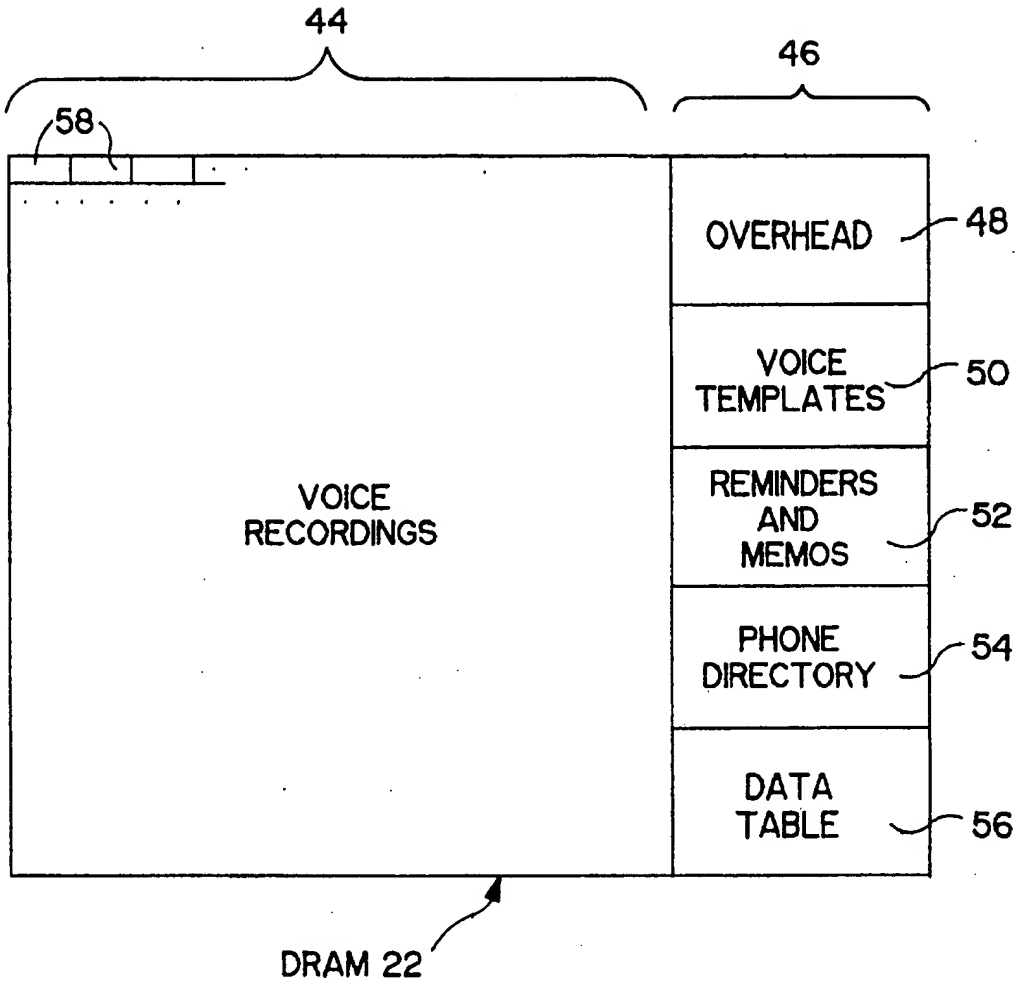

44
46
58
OVERHEAD
48
VOICE TEMPLATES
50
REMINDERS AND MEMOS
52
PHONE DIRECTORY
54
DATA TABLE
56
VOICE RECORDINGS
DRAM 22

FIG. 3

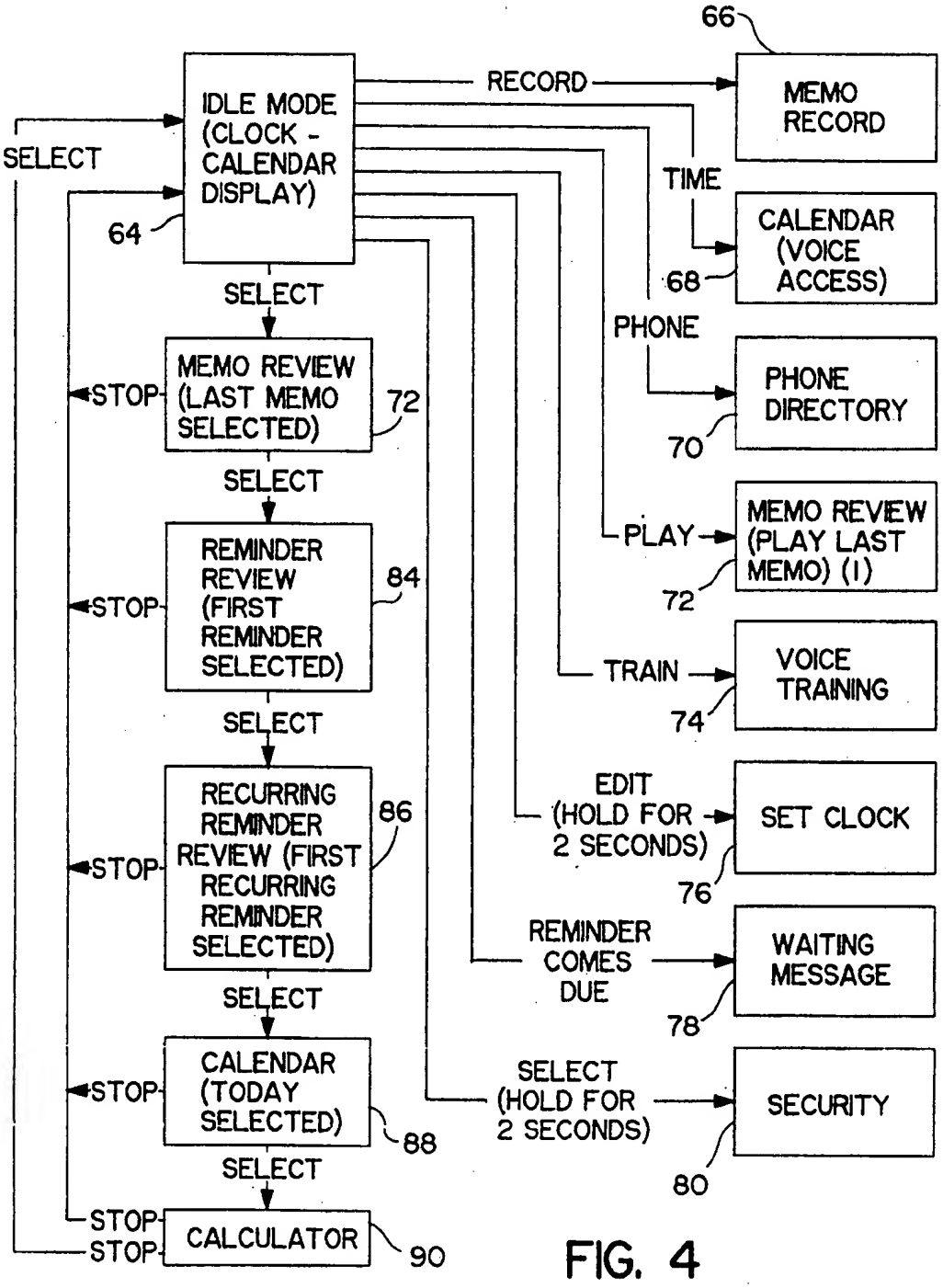

66
IDLE MODE (CLOCK - CALENDAR DISPLAY)
64
RECORD
MEMO RECORD
SELECT
TIME
CALENDAR (VOICE ACCESS)
68
PHONE
PHONE DIRECTORY
70
MEMO REVIEW (LAST MEMO SELECTED)
72
STOP
PLAY
MEMO REVIEW (PLAY LAST MEMO) (1)
72
REMINDER REVIEW (FIRST REMINDER SELECTED)
84
TRAIN
VOICE TRAINING
74
RECURRING REMINDER REVIEW (FIRST RECURRING REMINDER SELECTED)
86
EDIT (HOLD FOR 2 SECONDS)
SET CLOCK
76
REMINDER COMES DUE
WAITING MESSAGE
78
CALENDAR (TODAY SELECTED)
88
SELECT (HOLD FOR 2 SECONDS)
SECURITY
80
CALCULATOR
90

FIG. 4

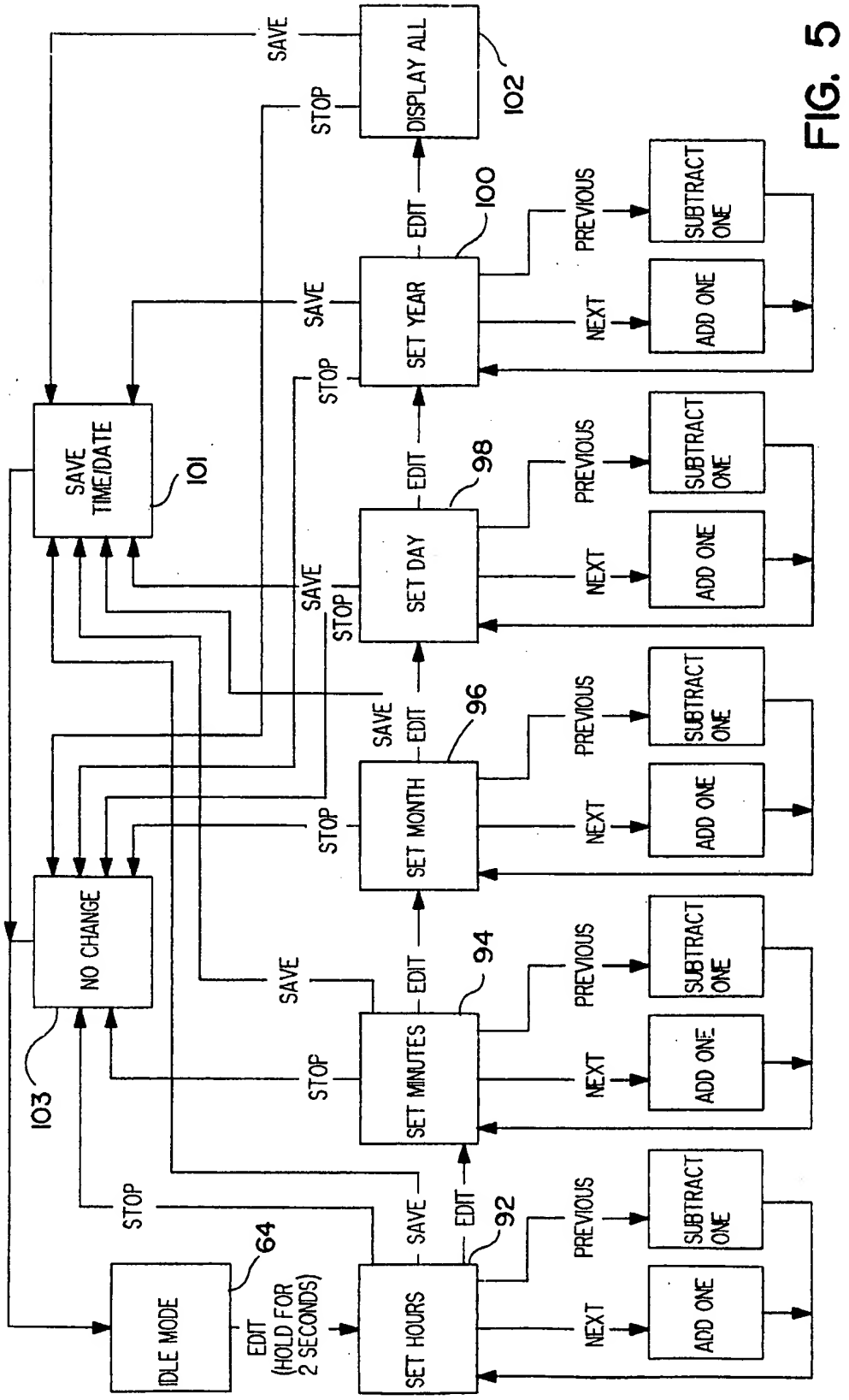

IDLE MODE
64
EDIT (HOLD FOR 2 SECONDS)
SET HOURS
92
SET MINUTES
94
SET MONTH
96
SET DAY
98
SET YEAR
100
DISPLAY ALL
102
SAVE TIME/DATE
101
NO CHANGE
103
EDIT
SAVE
STOP
PREVIOUS
NEXT
ADD ONE
SUBTRACT ONE

FIG. 5

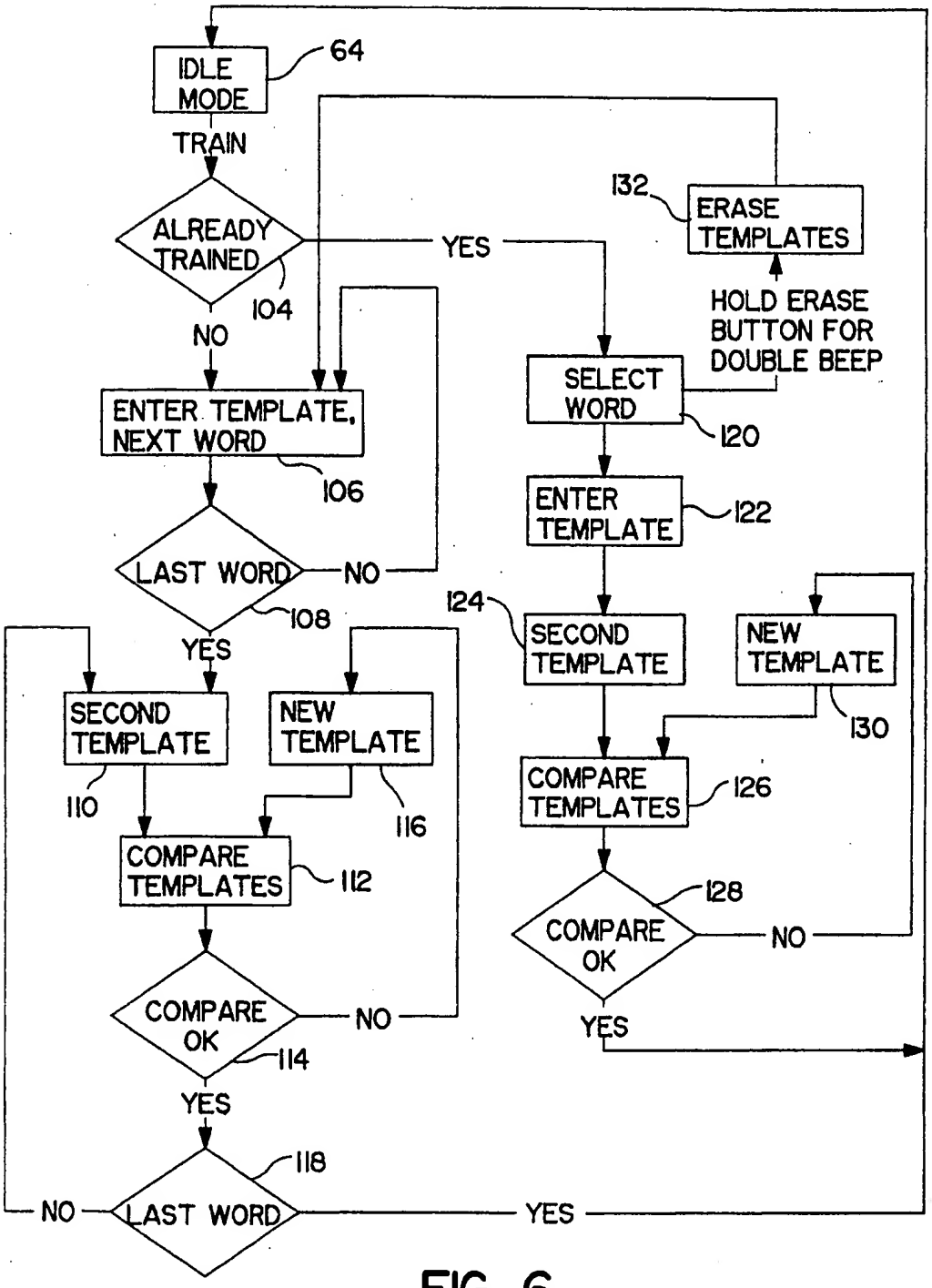

IDLE MODE
64
TRAIN
ALREADY TRAINED
104
YES
NO
ENTER TEMPLATE, NEXT WORD
106
LAST WORD
NO
108
YES
SECOND TEMPLATE
110
NEW TEMPLATE
116
COMPARE TEMPLATES
112
COMPARE OK
NO
114
YES
118
NO
LAST WORD
YES
132
ERASE TEMPLATES
HOLD ERASE BUTTON FOR DOUBLE BEEP
SELECT WORD
120
ENTER TEMPLATE
122
124
SECOND TEMPLATE
NEW TEMPLATE
130
COMPARE TEMPLATES
126
128
COMPARE OK
NO
YES

FIG. 6

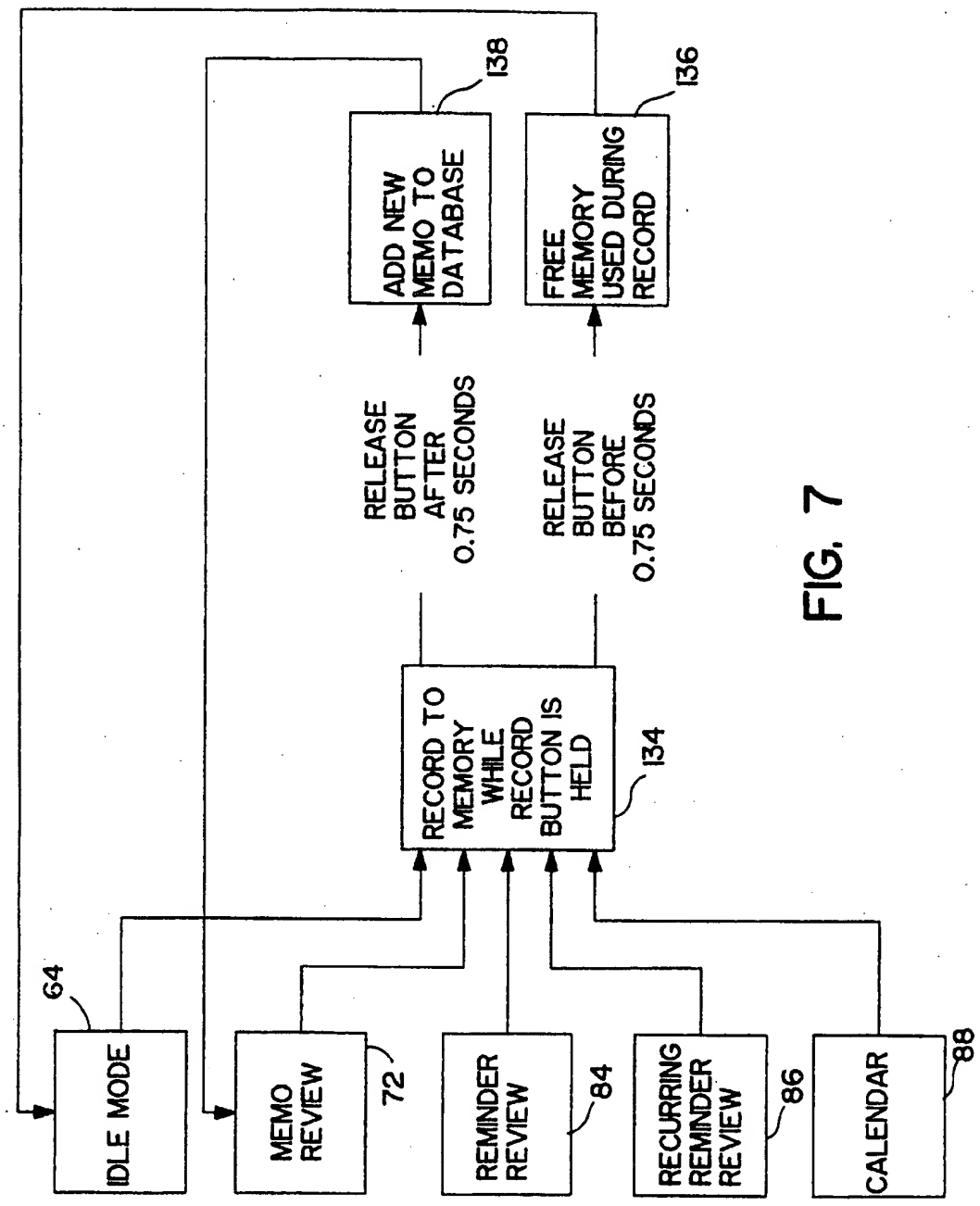

IDLE MODE
64
MEMO REVIEW
72
REMINDER REVIEW
84
RECURRING REMINDER REVIEW
86
CALENDAR
88
RECORD TO MEMORY WHILE RECORD BUTTON IS HELD
134
RELEASE BUTTON AFTER 0.75 SECONDS
RELEASE BUTTON BEFORE 0.75 SECONDS
ADD NEW MEMO TO DATABASE
138
FREE MEMORY USED DURING RECORD
136

FIG. 7

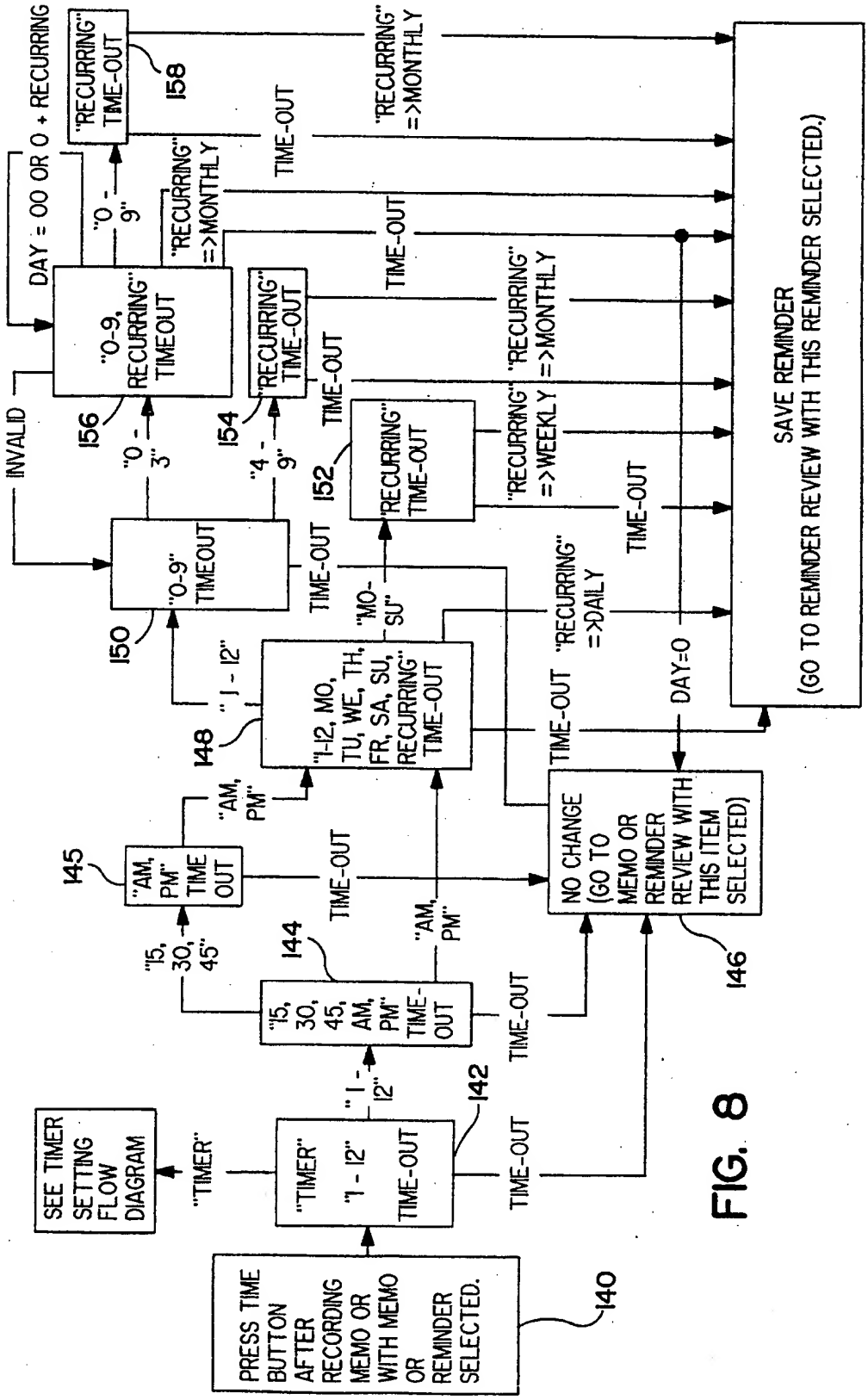

PRESS TIME BUTTON AFTER RECORDING MEMO OR WITH MEMO OR REMINDER SELECTED.
140
SEE TIMER SETTING FLOW DIAGRAM
"TIMER"
"TIMER" "1 - 12" TIME-OUT
142
" 1 - 12"
"15, 30, 45, AM, PM" TIME-OUT
144
"15, 30, 45"
"AM, PM" TIME OUT
145
"AM, PM"
"1-12, MO, TU, WE, TH, FR, SA, SU, RECURRING" TIME-OUT
148
" 1 - 12"
"0-9" TIMEOUT
150
"MO-SU"
"RECURRING" TIME-OUT
152
"4 - 9"
"0-9, RECURRING" TIMEOUT
154
"0 - 3"
"RECURRING" TIME-OUT
156
"0 - 9"
"RECURRING" TIME-OUT
158
DAY = 00 OR 0 + RECURRING
INVALID
TIME-OUT
"RECURRING" =>MONTHLY
"RECURRING" =>WEEKLY
"RECURRING" =>DAILY
NO CHANGE (GO TO MEMO OR REMINDER REVIEW WITH THIS ITEM SELECTED)
146
DAY=0
SAVE REMINDER (GO TO REMINDER REVIEW WITH THIS REMINDER SELECTED.)

FIG. 8

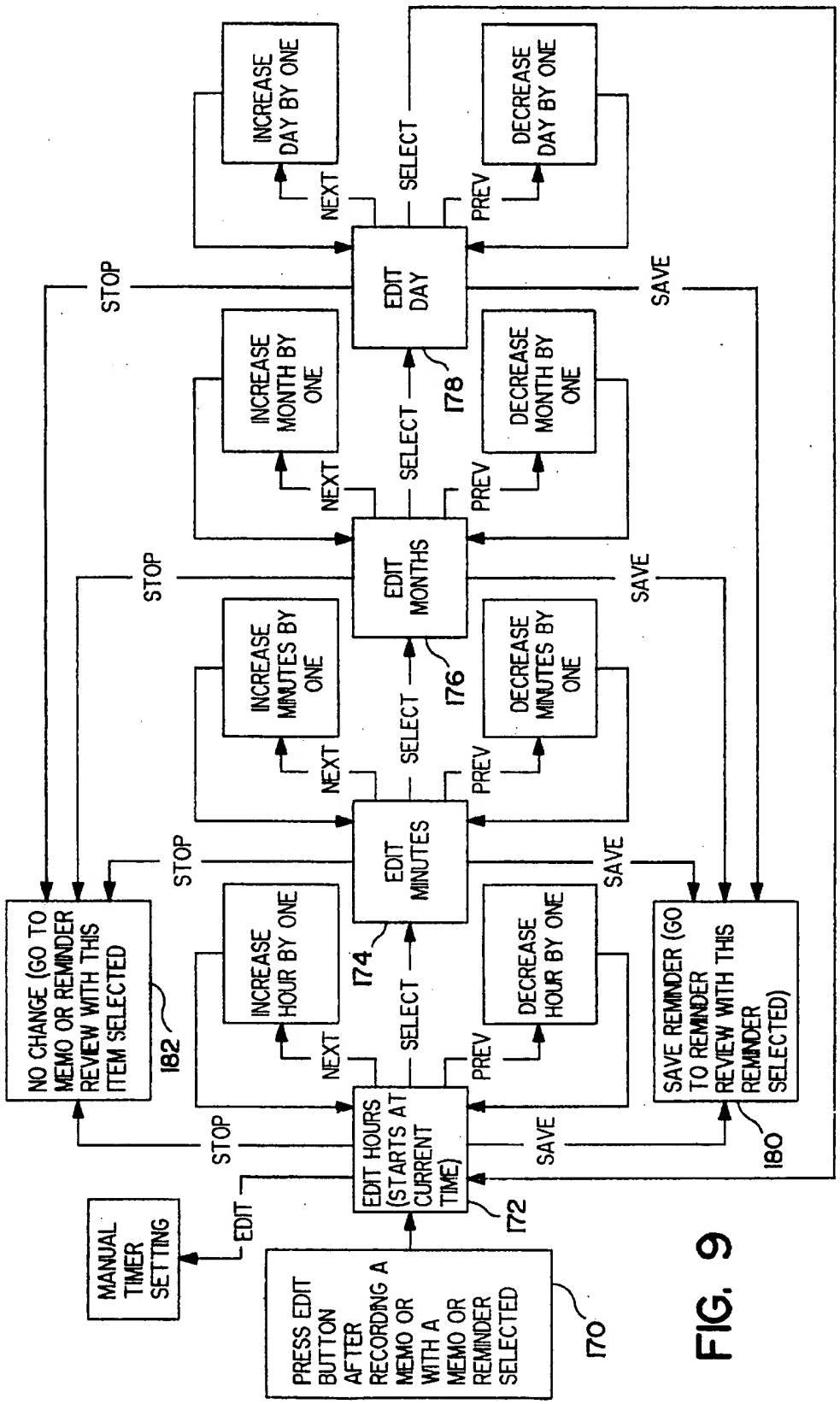

PRESS EDIT BUTTON AFTER RECORDING A MEMO OR WITH A MEMO OR REMINDER SELECTED
170
MANUAL TIMER SETTING
EDIT
EDIT HOURS (STARTS AT CURRENT TIME)
172
NO CHANGE (GO TO MEMO OR REMINDER REVIEW WITH THIS ITEM SELECTED
182
SAVE REMINDER (GO TO REMINDER REVIEW WITH THIS REMINDER SELECTED)
180
STOP
SAVE
INCREASE HOUR BY ONE
DECREASE HOUR BY ONE
NEXT
PREV
SELECT
174
EDIT MINUTES
INCREASE MINUTES BY ONE
DECREASE MINUTES BY ONE
176
EDIT MONTHS
INCREASE MONTH BY ONE
DECREASE MONTH BY ONE
178
EDIT DAY
INCREASE DAY BY ONE
DECREASE DAY BY ONE

FIG. 9

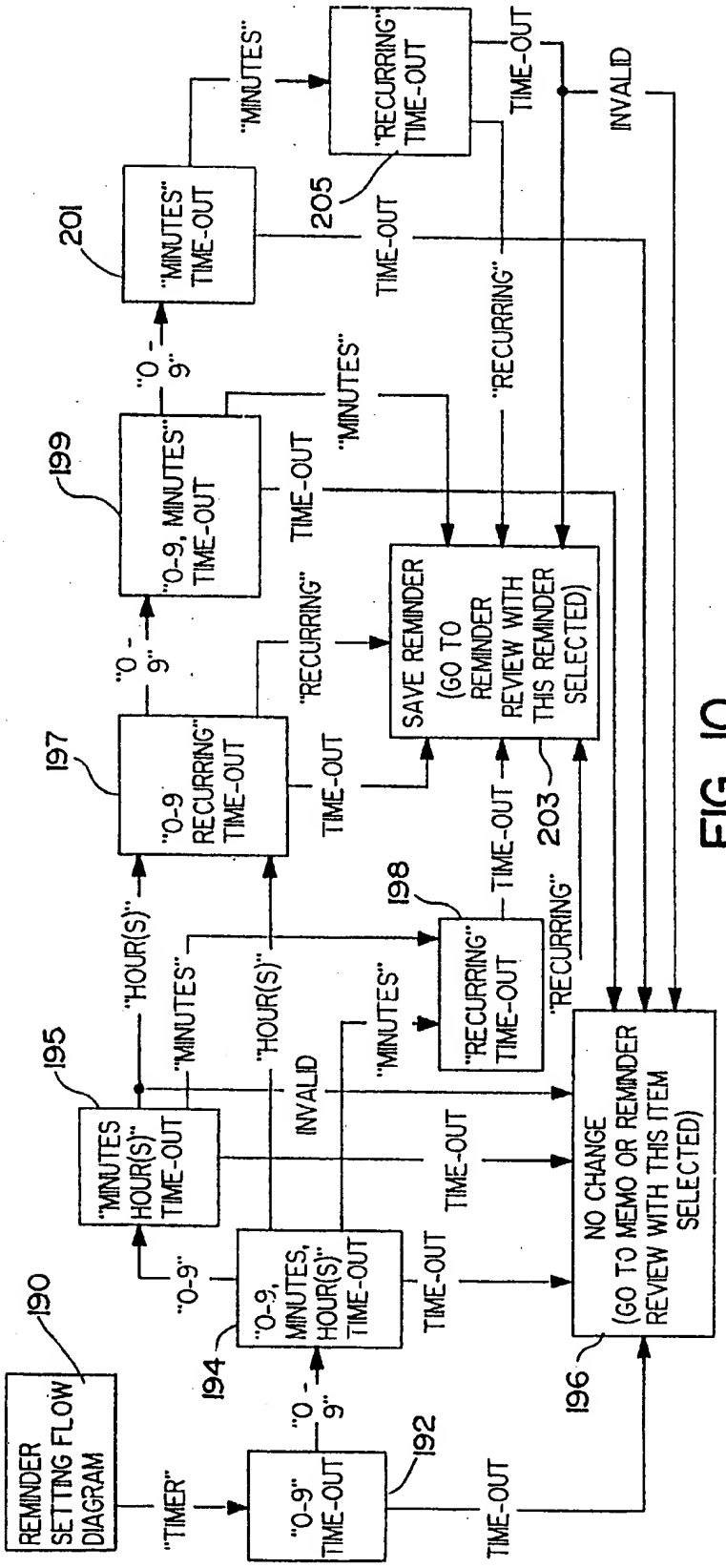

REMINDER SETTING FLOW DIAGRAM
190
"TIMER"
"0-9" TIME-OUT
192
"0 - 9"
"0-9, MINUTES, HOUR(S)" TIME-OUT
194
"0-9"
"MINUTES HOUR(S)" TIME-OUT
195
"HOUR(S)"
"MINUTES"
"0-9 RECURRING" TIME-OUT
197
"0 - 9"
"0-9, MINUTES" TIME-OUT
199
"0 - 9"
"MINUTES" TIME-OUT
201
"MINUTES"
"RECURRING" TIME-OUT
205
"HOUR(S)"
"MINUTES"
"RECURRING" TIME-OUT
198
"RECURRING"
SAVE REMINDER (GO TO REMINDER REVIEW WITH THIS REMINDER SELECTED)
203
NO CHANGE (GO TO MEMO OR REMINDER REVIEW WITH THIS ITEM SELECTED)
196
TIME-OUT
INVALID

FIG. 10

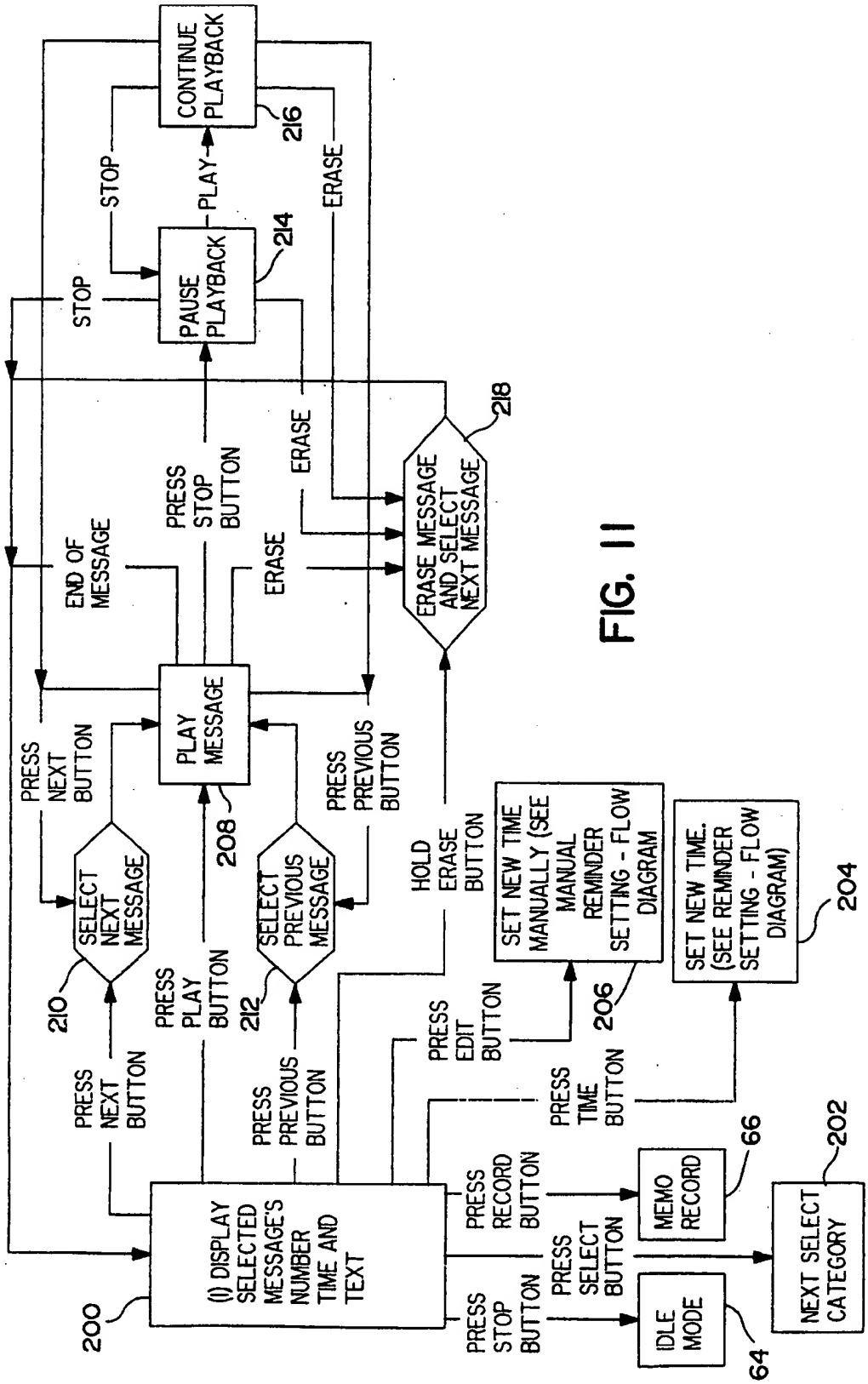
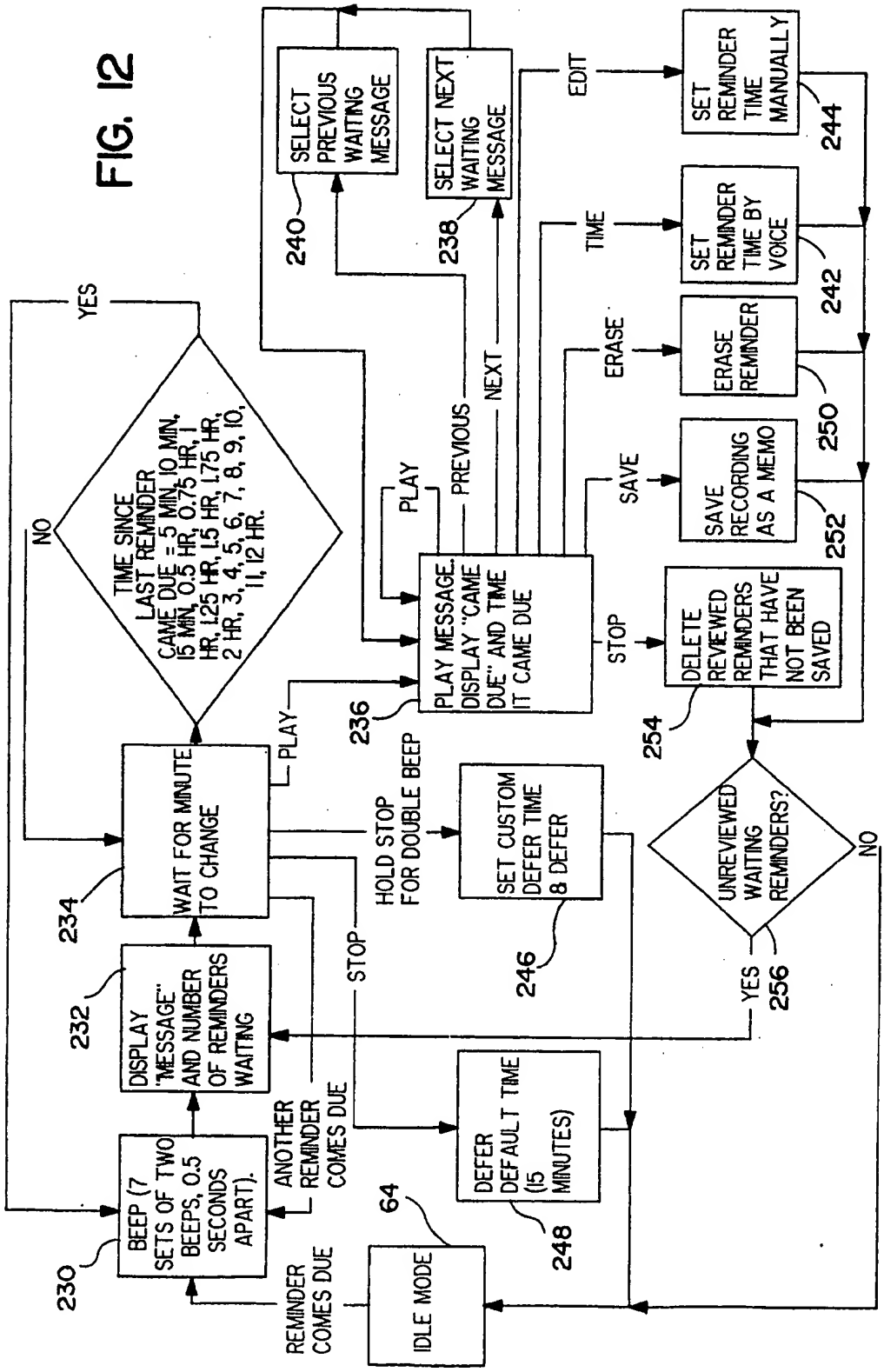

CONTINUE PLAYBACK
216
STOP
PLAY
ERASE
PAUSE PLAYBACK
214
STOP
ERASE
218
ERASE MESSAGE AND SELECT NEXT MESSAGE
END OF MESSAGE
PRESS STOP BUTTON
ERASE
PLAY MESSAGE
208
PRESS NEXT BUTTON
PRESS PREVIOUS BUTTON
SELECT NEXT MESSAGE
SELECT PREVIOUS MESSAGE
HOLD ERASE BUTTON
SET NEW TIME MANUALLY (SEE MANUAL REMINDER SETTING - FLOW DIAGRAM
206
SET NEW TIME. (SEE REMINDER SETTING - FLOW DIAGRAM)
204
210
212
PRESS PLAY BUTTON
PRESS NEXT BUTTON
PRESS PREVIOUS BUTTON
PRESS EDIT BUTTON
PRESS TIME BUTTON
(I) DISPLAY SELECTED MESSAGE'S NUMBER TIME AND TEXT
200
PRESS RECORD BUTTON
PRESS SELECT BUTTON
PRESS STOP BUTTON
MEMO RECORD
66
NEXT SELECT CATEGORY
202
IDLE MODE
64

FIG. 11

FIG. 12


64
IDLE MODE
REMINDER COMES DUE
230
BEEP (7 SETS OF TWO BEEPS, 0.5 SECONDS APART).
ANOTHER REMINDER COMES DUE
232
DISPLAY "MESSAGE" AND NUMBER OF REMINDERS WAITING
234
WAIT FOR MINUTE TO CHANGE
TIME SINCE LAST REMINDER CAME DUE = 5 MIN, 10 MIN, 15 MIN, 0.5 HR, 0.75 HR, 1 HR, 1.25 HR, 1.5 HR, 1.75 HR, 2 HR, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 HR.
YES
NO
PLAY
236
PLAY MESSAGE. DISPLAY "CAME DUE" AND TIME IT CAME DUE
HOLD STOP FOR DOUBLE BEEP
246
SET CUSTOM DEFER TIME & DEFER
STOP
DEFER DEFAULT TIME (15 MINUTES)
248
240
SELECT PREVIOUS WAITING MESSAGE
238
SELECT NEXT WAITING MESSAGE
PREVIOUS
NEXT
PLAY
STOP
EDIT
TIME
ERASE
SAVE
SET REMINDER TIME MANUALLY
244
SET REMINDER TIME BY VOICE
242
ERASE REMINDER
SAVE RECORDING AS A MEMO
250
252
DELETE REVIEWED REMINDERS THAT HAVE NOT BEEN SAVED
254
UNREVIEWED WAITING REMINDERS?
YES
NO
256

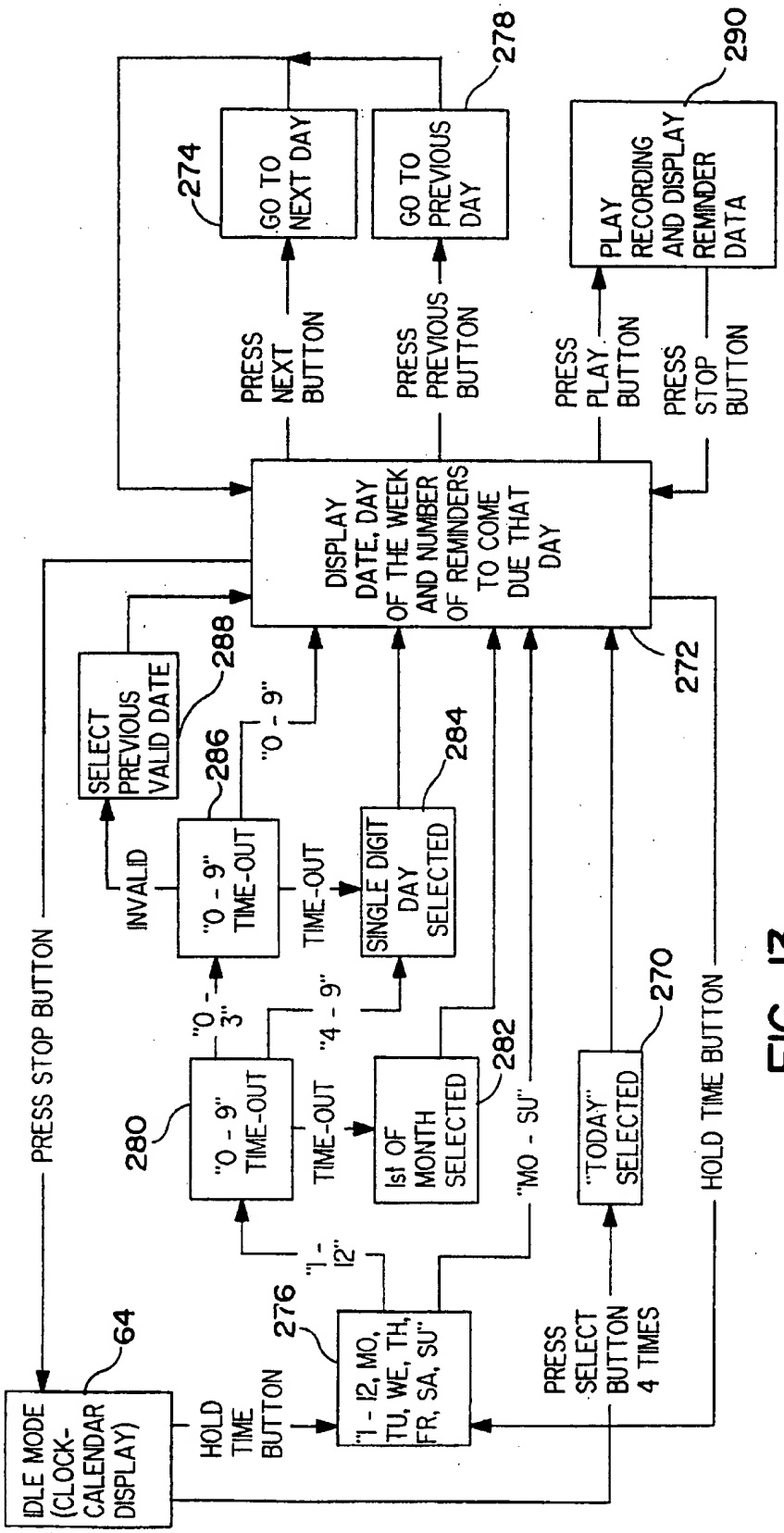

IDLE MODE (CLOCK-CALENDAR DISPLAY)
64
HOLD TIME BUTTON
"1 - 12, MO, TU, WE, TH, FR, SA, SU"
276
"1 - 12"
"0 - 3"
"4 - 9"
"0 - 9" TIME-OUT
280
TIME-OUT
1st OF MONTH SELECTED
282
"MO - SU"
"TODAY" SELECTED
270
PRESS SELECT BUTTON 4 TIMES
HOLD TIME BUTTON
PRESS STOP BUTTON
INVALID
"0 - 9" TIME-OUT
286
TIME-OUT
SINGLE DIGIT DAY SELECTED
284
"0 - 9"
SELECT PREVIOUS VALID DATE
288
DISPLAY DATE, DAY OF THE WEEK AND NUMBER OF REMINDERS TO COME DUE THAT DAY
272
PRESS NEXT BUTTON
PRESS PREVIOUS BUTTON
PRESS PLAY BUTTON
PRESS STOP BUTTON
274
GO TO NEXT DAY
GO TO PREVIOUS DAY
278
PLAY RECORDING AND DISPLAY REMINDER DATA
290

FIG. 13

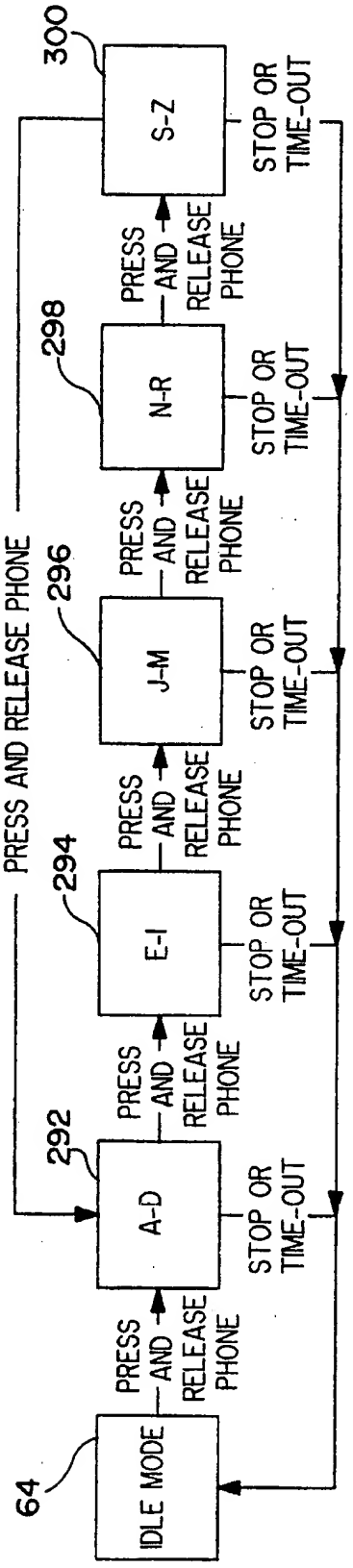

64
IDLE MODE
PRESS AND RELEASE PHONE
292
A-D
STOP OR TIME-OUT
PRESS AND RELEASE PHONE
294
E-I
STOP OR TIME-OUT
PRESS AND RELEASE PHONE
296
J-M
STOP OR TIME-OUT
PRESS AND RELEASE PHONE
298
N-R
STOP OR TIME-OUT
PRESS AND RELEASE PHONE
300
S-Z
STOP OR TIME-OUT

FIG. 14

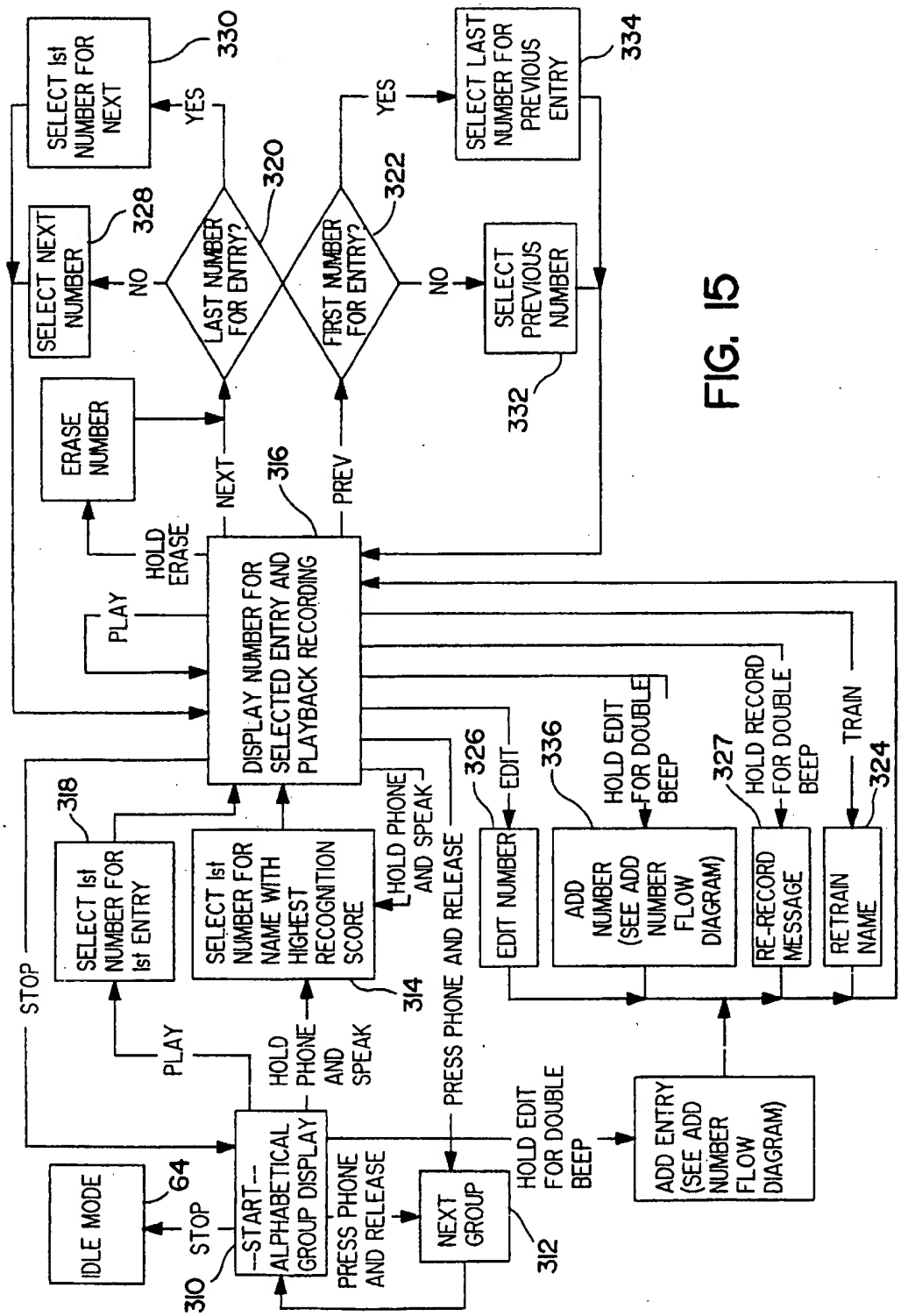

IDLE MODE
64
STOP
310
START--ALPHABETICAL GROUP DISPLAY
PRESS PHONE AND RELEASE
NEXT GROUP
312
HOLD EDIT FOR DOUBLE BEEP
ADD ENTRY (SEE ADD NUMBER FLOW DIAGRAM)
HOLD PHONE AND SPEAK
PLAY
STOP
SELECT 1st NUMBER FOR 1st ENTRY
318
SELECT 1st NUMBER FOR NAME WITH HIGHEST RECOGNITION SCORE
314
HOLD PHONE AND SPEAK
PRESS PHONE AND RELEASE
DISPLAY NUMBER FOR SELECTED ENTRY AND PLAYBACK RECORDING
316
EDIT NUMBER
326
EDIT
ADD NUMBER (SEE ADD NUMBER FLOW DIAGRAM)
336
HOLD EDIT FOR DOUBLE BEEP
RE-RECORD MESSAGE
327
HOLD RECORD FOR DOUBLE BEEP
RETRAIN NAME
324
TRAIN
PLAY
HOLD ERASE
ERASE NUMBER
NEXT
PREV
LAST NUMBER FOR ENTRY?
320
FIRST NUMBER FOR ENTRY?
322
NO
SELECT NEXT NUMBER
328
YES
SELECT 1st NUMBER FOR NEXT
330
NO
SELECT PREVIOUS NUMBER
332
YES
SELECT LAST NUMBER FOR PREVIOUS ENTRY
334

FIG. 15

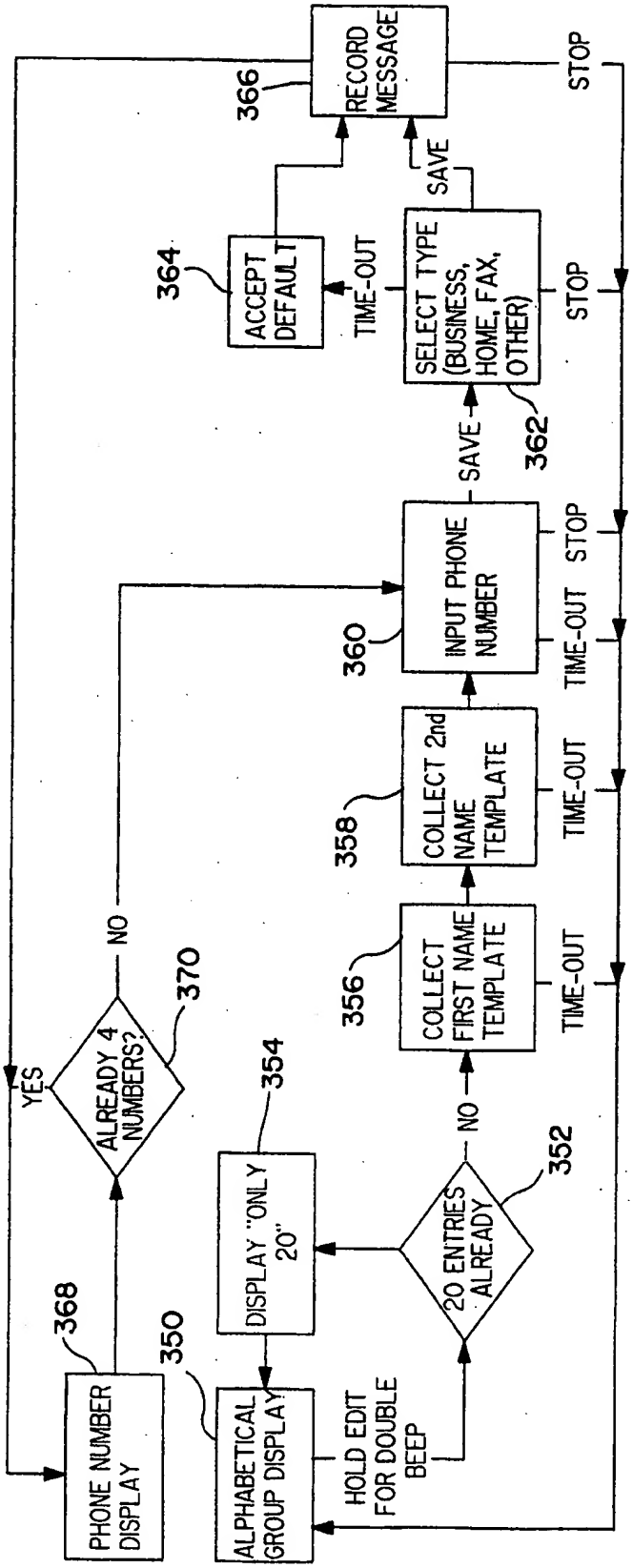

PHONE NUMBER DISPLAY
368
ALPHABETICAL GROUP DISPLAY
350
HOLD EDIT FOR DOUBLE BEEP
DISPLAY "ONLY 20"
354
20 ENTRIES ALREADY
352
NO
YES
ALREADY 4 NUMBERS?
370
NO
COLLECT FIRST NAME TEMPLATE
356
TIME-OUT
COLLECT 2nd NAME TEMPLATE
358
TIME-OUT
INPUT PHONE NUMBER
360
TIME-OUT
STOP
SAVE
SELECT TYPE (BUSINESS, HOME, FAX, OTHER)
362
TIME-OUT
STOP
SAVE
ACCEPT DEFAULT
364
TIME-OUT
RECORD MESSAGE
366
STOP

FIG. 16

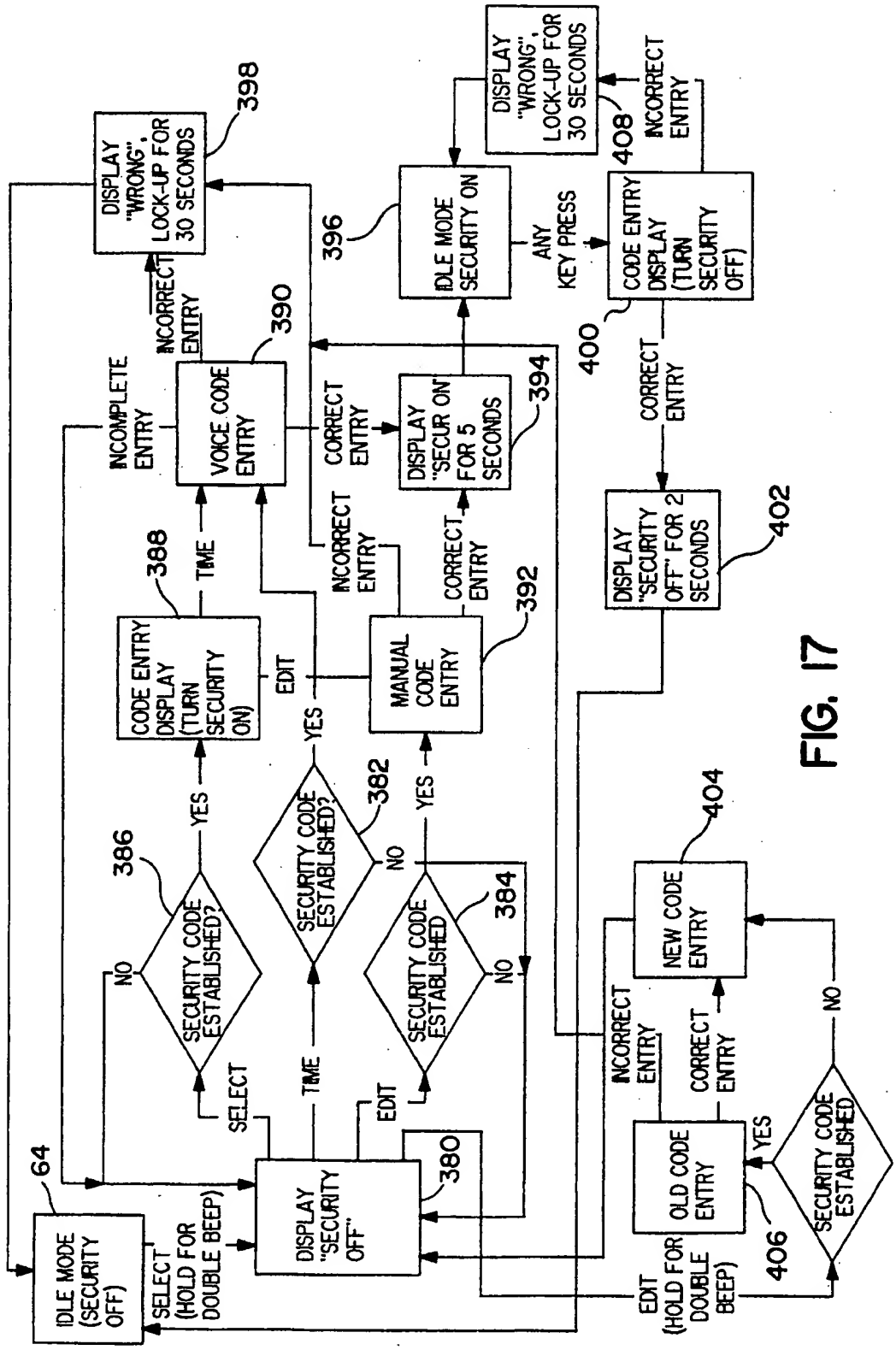

IDLE MODE (SECURITY OFF)
64
SELECT (HOLD FOR DOUBLE BEEP)
DISPLAY "SECURITY OFF"
380
SELECT
TIME
EDIT
SECURITY CODE ESTABLISHED?
386
NO
YES
SECURITY CODE ESTABLISHED?
382
NO
YES
SECURITY CODE ESTABLISHED
384
NO
YES
CODE ENTRY DISPLAY (TURN SECURITY ON)
388
TIME
EDIT
MANUAL CODE ENTRY
392
INCOMPLETE ENTRY
INCORRECT ENTRY
VOICE CODE ENTRY
390
INCORRECT ENTRY
CORRECT ENTRY
DISPLAY "SECUR ON" FOR 5 SECONDS
394
CORRECT ENTRY
IDLE MODE SECURITY ON
396
DISPLAY "WRONG", LOCK-UP FOR 30 SECONDS
398
ANY KEY PRESS
CODE ENTRY DISPLAY (TURN SECURITY OFF)
400
INCORRECT ENTRY
DISPLAY "WRONG", LOCK-UP FOR 30 SECONDS
408
CORRECT ENTRY
DISPLAY "SECURITY OFF" FOR 2 SECONDS
402
NEW CODE ENTRY
404
INCORRECT ENTRY
CORRECT ENTRY
OLD CODE ENTRY
EDIT (HOLD FOR DOUBLE BEEP)
SECURITY CODE ESTABLISHED
406
NO
YES

FIG. 17

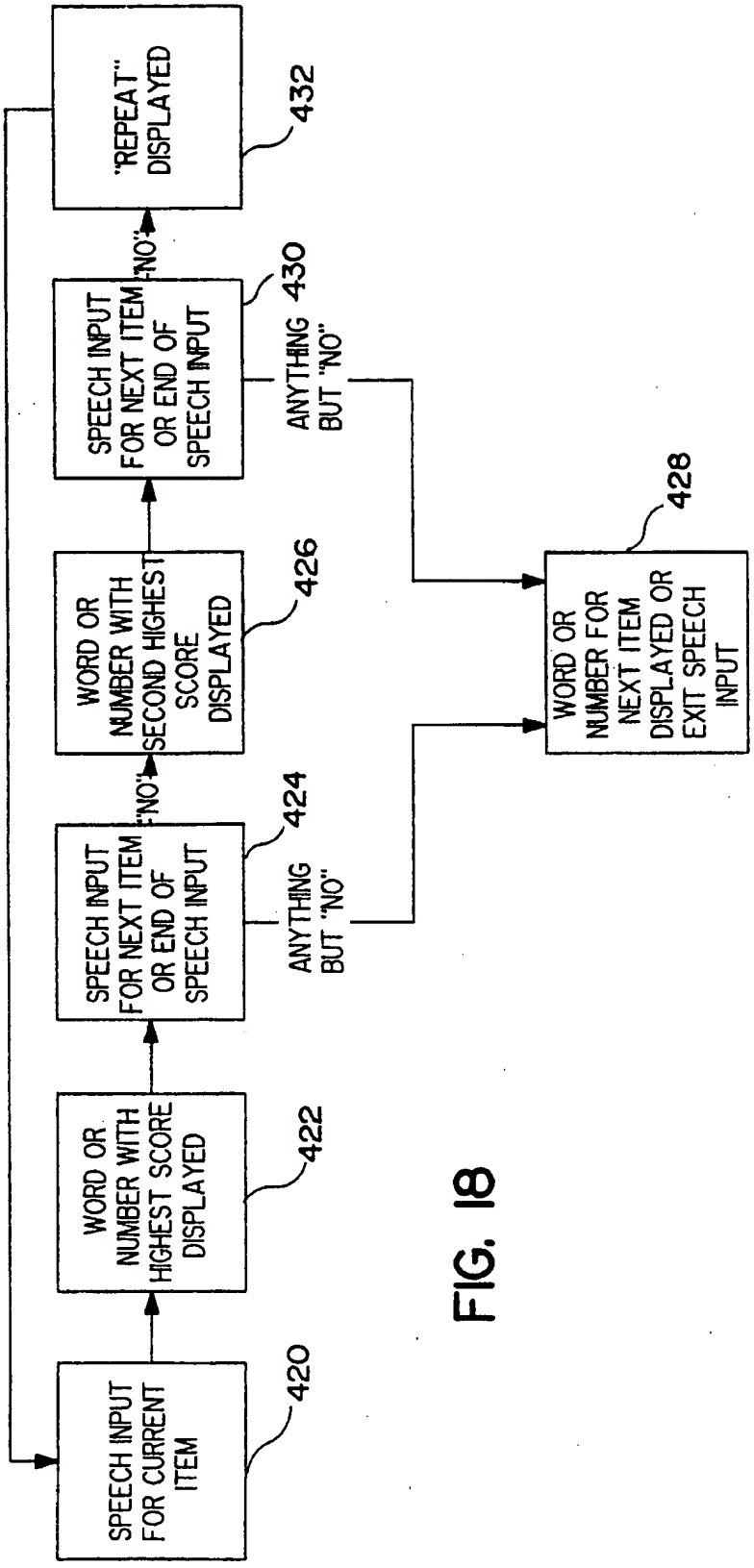

SPEECH INPUT FOR CURRENT ITEM
420
WORD OR NUMBER WITH HIGHEST SCORE DISPLAYED
422
SPEECH INPUT FOR NEXT ITEM OR END OF SPEECH INPUT
424
"NO"
ANYTHING BUT "NO"
WORD OR NUMBER WITH SECOND HIGHEST SCORE DISPLAYED
426
SPEECH INPUT FOR NEXT ITEM OR END OF SPEECH INPUT
430
"NO"
ANYTHING BUT "NO"
"REPEAT" DISPLAYED
432
WORD OR NUMBER FOR NEXT ITEM DISPLAYED OR EXIT SPEECH INPUT
428

FIG. 18

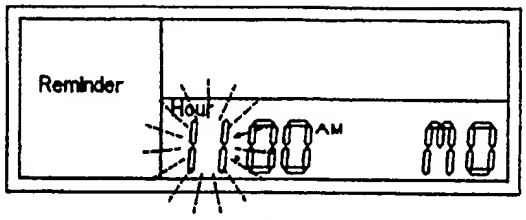


FIG. 19A

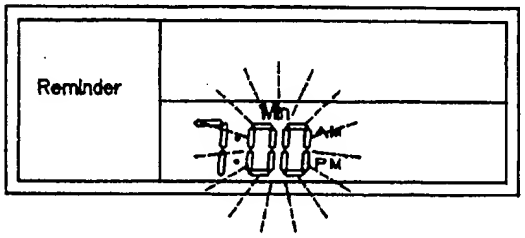


FIG. 19B

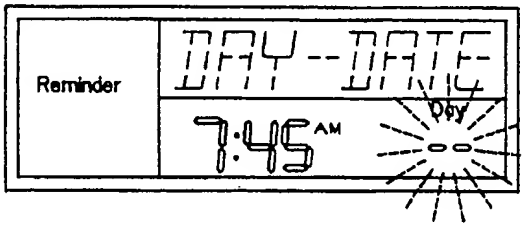


FIG. 19C

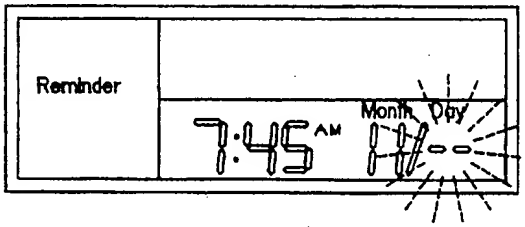


FIG. 19D

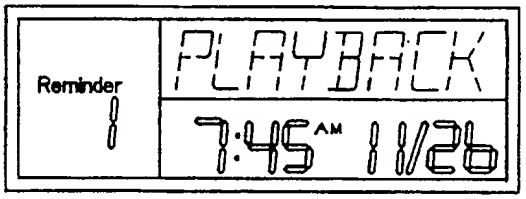


FIG. 19E

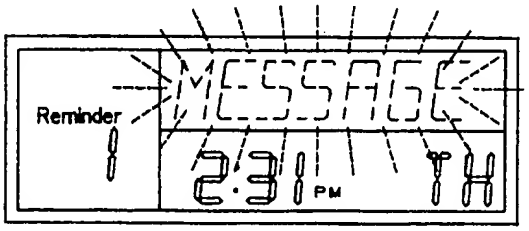


FIG. 19F

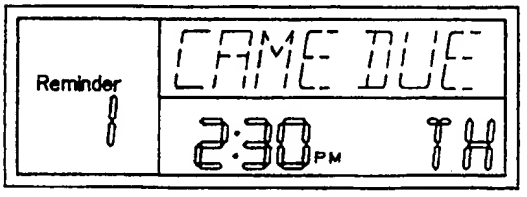


FIG. 19G

VOICE ACTIVATED PERSONAL ORGANIZER

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to personal organizers for electronically storing messages, reminders, phone numbers, addresses, and other such data, and more particularly to personal organizers which are voice activated.

2. History of the Prior Art

Many types of electronic personal organizers or "data banks" are presently available. Such organizers range from simple devices that allow for storage of phone numbers, addresses and appointments, to more complicated devices that approach the capabilities of small computers. All such devices require data to be entered using a keyboard. Simpler devices may use a calculator type keyboard, while more complex devices typically require a computer/typewriter type of keyboard.

In presently available electronic personal organizers, the user typically selects a function by pressing one or more keys on the keyboard. The user then enters data using the keyboard, usually filling out a predefined form for the function selected. For example, a phone directory entry typically requires the user to type the name of the person or organization to be added to the directory, in a specific field. The user then indicates by keystroke when the filling of the field is finished. The organizer then automatically moves to the next field, where the user inputs the phone number. This field may be further subdivided into area code and phone number. When entry of the information is finished, the user indicates by keypress that the entry is to be saved.

Retrieval of data is accomplished by similar keypress operations, in conventional electronic personal organizers. The user again begins by selecting the function, following which a search for the desired information is begun. In the case of the phone directory previously referred to, the user may simply scroll through the directory looking for the desired entry, with a single keypress being used to advance from one entry to the next. A more sophisticated search is often provided, by which the user may type the first letter (or perhaps more) of the name. This causes the directory to skip to the appropriate alphabetical region.

In conventional electronic personal organizers, a second type of data is often stored. Instead of being stored for later retrieval at the user's initiation, this data is interpreted by the organizer so as to ultimately cause the organizer to take a particular action at a later time, with no further action on the part of the user being required. For example, a time and date can be entered in a reminder function. The organizer keeps track of the time in order to automatically alert the user when the selected time arrives, with no user intervention being required. Thus, an alarm function is performed. Typically, a message is associated with the alarm function to provide the reminder with some context. The message as well as the alarm time are entered by keystrokes in a form similar to that described previously in connection with the phone directory example.

When using conventional electronic personal organizers in the manner described, the user must type in information using a small keypad. The keypad must be of minimum size in order for the keys to be usable. This conflicts with the need to make the organizer as small and portable as possible. Elimination of the need for a complete keypad for data input and retrieval would eliminate the need for compromise, allowing the organizer to be made small and portable and at the same time easily used. As previously noted, conventional electronic personal organizers typically require a computer/typewriter type keyboard for complete flexibility in entry of number data, such as phone numbers, times and dates, and text data, such as memos. This requires a certain level of skill on the user's part, and can be quite time consuming. Also, the large number of keys required results in the unit being relatively large.

For this reason, voice activation and other voice recognition techniques have provided a useful alternative to the need for elaborate user interfacing through use of a large keyboard, in certain electronic devices. Examples of voice activated electronic devices include remote controls which utilize sophisticated electronics to recognize spoken words, translate the commands of the user into traditional digital remote control signals, and transmit the control signals to a controlled device. Examples of such systems are provided by co-pending application Ser. No. 07/915,112 of Bissonnette et al., entitled Voice Operated Remote Control Device, by co-pending application Ser. No. 07/915,938 of Bissonnette et al., entitled Voice Recognition Apparatus and method, and by co-pending application Ser. No. 07/915,114 of Fischer, entitled Remote Control Device. All three applications were filed on Jul. 17, 1992 and are commonly assigned with the present application.

A further example of a voice operated remote control system is provided by co-pending application Ser. No. 08/113,394 of Fischer et al., entitled Voice Operated Remote Control System. The Fischer et al. application, which was filed Aug. 27, 1993 and which is commonly assigned with the present application, describes a system which includes a remote control device responsive to the voice commands of the user to transmit representations of the voice commands to a controlled device. The controlled device produces voice signals in response to the transmitted representations, and includes voice recognition circuitry for recognizing the transmitted voice commands and executing action routines denoted thereby.

Voice recognition techniques have also been applied to systems capable of performing organizer type functions. Typically, such systems are very large in size in order to accommodate the data storage and other functions. This severely limits their applicability to small, portable, hand-held applications. An example of such systems is provided by U.S. Pat. No. 5,014,317 of Kita et al., which describes recording and reproducing apparatus in which externally input voice commands stating an alarm time are converted into voice data for storage in a memory together with an associated message. When the alarm time is reached, the corresponding voice data stored in the memory is read out and audibly reproduced so as to sound the alarm time and play back the associated message.

The system described in Kita et al. is exemplary of extremely complex systems which are difficult and expensive to implement, and yet which are limited in terms of their flexibility in changing or correcting data and in terms of the functions which they otherwise can perform. Such systems typically carry out voice recognition and voice recording simultaneously, thereby requiring a substantial amount of hardware.

In addition to the large, elaborate, computer type systems such as that described in Kita et al., voice recognition techniques have been applied to smaller systems where the functions may be simpler and easier to perform in compact

environments. An example of this is provided by U.S. Pat. No. 4,882,685 of van der Lely, which patent describes a calculator responsive to certain action words such as "add", "subtract", "multiply", and "divide". Other examples of such systems are provided by patents relating to automatic telephone dialers. Such patents include U.S. Pat. No. 4,644,107 of Clowes et al., U.S. Pat. No. 5,007,081 of Schmuckal et al., U.S. Pat. No. 4,928,302 of Kaneuchi et al., and U.S. Pat. No. 4,864,622 of Iida et al.

In developing electronic personal organizers, it has become apparent that digital voice recording is a significantly easier and more natural method than text to input and store data. Furthermore, input data in the form of numbers, dates, times, and the like, can be handled in a more natural and simpler way by utilizing voice recognition technology. However, while such techniques greatly simplify use of the organizer, they do so at the expense of considerably greater complexity in the implementation of the organizer. This is a particular problem if the organizer is to be produced in a small, portable form. Thus, whereas a text memo typed into a conventional organizer using a keyboard will typically require 7 or 8 bits for each character, and a simple message such as "Call the office and speak with Bob" will typically require 238–272 bits, plus several additional "overhead" bits to keep the stored information organized, an organizer utilizing digital voice recording and voice recognition of data input will typically require 16,000–32,000 bits for proper storage of a sentence requiring only 1–2 seconds to speak. In addition to such storage requirements, there is the added requirement of providing the electronics for voice input and playback, including a microphone, a speaker, and appropriate amplifiers.

In such organizers utilizing voice recognition, there is the increased requirement of additional componentry for implementing the voice recognition process. There is also the need for sufficient processing power to enable a voice recognition algorithm to be run, and increased memory requirements both for the program memory, typically a ROM, for storage of the recognition algorithm and other parts of the organizer program, as well as a read-write type memory, typically a RAM, for storage of information pertaining to the voice of the user. At that, such added memory requirements are but a small fraction of the memory requirements for voice recording.

To make the implementation practical, the voice recognition requirements must be limited. The method of use should provide context for the recognition function, to allow for voice recognition with the limited processing power obtainable in a small, portable device. For example, requiring recognition during a continuous stream of speech on a few key words placed at varying points within the utterance would require a large, complex computer system.

Accordingly, there is a need for an electronic personal organizer capable of digitally storing reasonable amounts of message data, and facilitating the use thereof through appropriate voice recognition techniques. At the same time, such an organizer must be capable of implementation in a small, portable, hand-held package in order for it to be practical and to lend itself to large-scale use.

BRIEF SUMMARY OF THE INVENTION

Briefly stated, the present invention provides an electronic personal organizer which provides for data entry and retrieval using voice for commands as well as data input. Two types of voice interaction are provided; digital voice recording and voice recognition. A minimal number of buttons or other manual controls are required, enabling a less complicated device with ease of user interface.

In electronic organizers according to the invention, voice recognition is performed on words spoken by the user to input data into the organizer. At the same time, voice messages from the user are recorded in the organizer. The organizer follows a set routine so that it can readily be determined when voice input from the user comprises input data for the voice recognition process and when the voice input is a message to be stored. The voice messages are preferably compressed and then converted into digital signals for storage in a memory. The spoken words and the voice messages may be input using a microphone.

In electronic organizers according to the invention, voice recognition is carried out by implementing a voice recognition algorithm in conjunction with templates previously made from a user's voice and stored. When setting up the organizer for use, the user is required to speak each of a limited vocabulary of key words into the organizer, for creation and storage of the digital templates corresponding to the user's spoken words. Thereafter, as the user speaks the various words, the spoken words are compared with the stored templates in search of matches which denote recognition of certain ones of the key words. The various templates are trained until acceptable matches with the user's voice can be confirmed. Thereafter, the templates can be periodically corrected or retrained as appropriate.

The voice messages stored in the electronic organizer are selectively played back by converting such messages into analog signals and amplifying and filtering such signals before application to a speaker to produce the audio sounds corresponding thereto.

The electronic organizer includes a liquid crystal display or similar display together with a limited keypad. The keypad provides for manual entry of a limited number of selections and commands in connection with the voice recognition process. The display provides information feedback to the user, to facilitate interaction between the user and the organizer.

The electronic organizer includes a microcontroller having a plurality of different memories for storage of information together with a microprocessor and a stored program. The program establishes a set operating routine for the organizer, whereby various different predetermined functions may be carried out. By having a set operating routine, the organizer can determine which voice inputs require voice recognition in accordance with the limited vocabulary of key words and which voice inputs comprise voice messages to be stored.

Various functions which the electronic organizer is capable of performing include memo record, reminder, manual reminder, timer setting, message review, phone group select, number retrieval, add phone number, security, and "no" logic.

BRIEF DESCRIPTION OF THE DRAWINGS

A better understanding of the invention may be had by reference to the following specification in conjunction with the accompanying drawings, in which:

FIG. **1** is a block diagram of a voice activated personal organizer in accordance with the invention;

FIG. **2** is a plan view of the voice activated personal organizer electronically represented by the block diagram of

FIG. 1 and showing the limited keypad made possible in accordance with the invention;

FIG. 3 is a pictorial representation of the different types of data stored in the DRAM of the voice activated personal organizer of FIG. 1;

FIG. 4 is a flow diagram of the idle mode/select operation mode software routine implemented in the control program of the voice activated personal organizer of FIG. 1;

FIG. 5 is a flow diagram of the set clock operation mode software routine implemented in the control program of the voice activated personal organizer of FIG. 1;

FIG. 6 is a flow diagram of the voice training operation mode software routine implemented in the control program of the voice activated personal organizer of FIG. 1;

FIG. 7 is a flow diagram of the memo record operation mode software routine implemented in the control program of the voice activated personal organizer of FIG. 1;

FIG. 8 is a flow diagram of the reminder setting operation mode software routine implemented in the control program of the voice activated personal organizer of FIG. 1;

FIG. 9 is a flow diagram of the manual reminder operation mode software routine implemented in the control program of the voice activated personal organizer of FIG. 1;

FIG. 10 is a flow diagram of the timer setting operation mode software routine implemented in the control program of the voice activated personal organizer of FIG. 1;

FIG. 11 is a flow diagram of the message review operation mode software routine implemented in the control program of the voice activated personal organizer of FIG. 1;

FIG. 12 is a flow diagram of the waiting message operation mode software routine implemented in the control program of the voice activated personal organizer of FIG. 1;

FIG. 13 is a flow diagram of the calendar operation mode software routine implemented in the control program of the voice activated personal organizer of FIG. 1;

FIG. 14 is a flow diagram of the phone group select operation mode software routine implemented in the control program of the voice activated personal organizer of FIG. 1;

FIG. 15 is a flow diagram of the number retrieval operation mode software routine implemented in the control program of the voice activated personal organizer of FIG. 1;

FIG. 16 is a flow diagram of the add phone number operation mode software routine implemented in the control program of the voice activated personal organizer of FIG. 1;

FIG. 17 is a flow diagram of the security operation mode software routine implemented in the control program of the voice activated personal organizer of FIG. 1;

FIG. 18 is a flow diagram of the "No" logic operation mode software routine implemented in the control program of the voice activated personal organizer of FIG. 1; and

FIGS. 19A–19G are illustrations of different visual displays provided by the voice activated personal organizer of FIG. 1 during various operations thereof.

DETAILED DESCRIPTION

FIG. 1 is a block diagram of a voice activated personal organizer **10** in accordance with the invention. The description of FIG. 1 and of the various flow diagrams in subsequent figures of the drawings which relate thereto are provided by way of example only. Accordingly, it will be apparent to those skilled in the art that other arrangements and software routines are possible in accordance with the invention.

In the present example, the organizer **10** includes a microcontroller **12**, which is the key component of the organizer **10** inasmuch as it manages operation of the overall system of the organizer **10** in addition to operating the voice recognition algorithms. The microcontroller **12** includes a ROM (read only memory) **14** which stores a program for operating the organizer **10** as well as static data used in implementing the functions of the organizer **10**. The ROM **14** is shown in FIG. 1 as an internal part of the microcontroller **12**, but it will be understood that the ROM **14** and other components like it can alternatively comprise separate components located external to the microcontroller **12**.

Also contained within the microcontroller **12** is a RAM (random access memory) **16** which is used for local temporary storage of data necessary for the microcontroller **12** to fully implement the functions required. The microcontroller **12** further includes an A/D (analog-to-digital) converter **18** for converting inputted voice signals to digital form. The microcontroller **12** includes LCD (liquid crystal display) drive circuitry for driving an LCD **20**.

In addition to the RAM **16** which is internal to the microcontroller **12**, the organizer **10** has a larger amount of RAM memory external to the microcontroller **12**, for more permanent storage of several types of data. This is accomplished by a DRAM **22**, although it should be understood that other types of memories can also be used. As shown in dotted outline, additional expansion memories can be provided as necessary. The DRAM **22** stores "voice templates" that are collected during the set-up process to enable recognition of a specific user's voice. The DRAM **22** is also used to store the dates and times for any reminders, as well as phone numbers for the phone directory function. The DRAM **22** also contains "flags" for each such item indicating, for example, that a phone number is a home number or a work number, or that a reminder is to occur weekly, or daily, or one time only. The bulk of the DRAM **22** is used for the storage of digital voice recordings.

In the organizer **10** of FIG. 1, a sound transducer for incoming voice commands and messages from the user is provided by a microphone **24**. The microphone **24** converts the acoustic waves generated by the user's voice into analog electronic signals, which are amplified and filtered by an analog input amplifier and filter **26**. The analog input amplifier and filter **26** amplifies and filters the signals from the microphone **24** in such a way as to optimize the capabilities of the voice recognition algorithms employed by the microcontroller **12**. At the same time, such analog signal is also amplified and filtered by the analog input amplifier and filter **26** in such a way as to optimize the recording quality. Consequently, the overall transfer function of the signal path from the microphone **24** to a voice compression and decompression circuit **28** is different from the transfer function of the path from the microphone **24** to the A/D converter **18** to implement the voice recognition algorithms. The difference is necessary because the optimal signals for the two processes, namely recording of messages and voice recognition, are different. Such differences are in part made necessary by the hardware approach to compression and decompression provided by the voice compression and decompression circuit **28**.

As previously noted, the voice signal received by the microphone **24** and processed by the analog input amplifier and filter **26** is applied directly to the A/D converter **18** of the microcontroller **12** for voice recognition. The A/D converter **18**, which could be external to the microcontroller **12** instead of forming an internal component thereof as shown, converts the analog voice signal into a digital signal which the

microcontroller **12** can use. At the same time, voice signals to be recorded are provided by the analog input amplifier and filter **26** to the voice compression and decompression circuit **28**. In the present example, the voice compression and decompression circuit **28** implements a Continuously Variable Slope Delta Modulation (CVSD) compression and decompression algorithm. Consequently, the circuit **28** is a form of A/D converter, but at the same time one that significantly processes and thus compresses the amount of digital data that results for conversion of the analog voice signal to the digital voice signal. This allows a minimum of memory to be used for recording the voice messages. The data comprising such voice messages is stored in the DRAM **22**. The CVSD compression and decompression algorithm also converts the stored compressed digital voice signals back into analog voice signals for playback, via an analog output amplifier and filter **30** and a speaker **32**. The analog output amplifier and filter **30** optimizes the sound quality for reproduction by the speaker **32**.

The LCD (liquid crystal display) **20** is utilized to visually feed back information to the user of the organizer **10**. As shown in FIG. **2** as well as in FIG. **1**, the organizer **10** has a keypad **34** of limited size, to enable the user to interact with the organizer **10**. The keypad **34** has but **12** keys, which are denoted and used to perform functions as follows:

Key	Function
record	used for making voice recordings
phone	used for phone directory input and retrieval
select	used to select functions for review/use
time	used for voice input of times/dates and other data
play	used for playing back recordings
next	used to advance to the next item
prev	used to move to the previous item
stop	used to abort the present operation
train	used for training the organizer to the user's voice
save	used to store information in the RAM
erase	used to eliminate information from the RAM
edit	used for entering editing and manual input modes

As shown in FIG. **1**, the organizer **10** is powered by a primary battery circuit **36** which is comprised of several rechargeable batteries coupled in series, together with a voltage regulator, and two voltage comparators which provide an indication of the status of the batteries in order to warn the user of the need for recharging the batteries, and so that the microcontroller **12** can shut down all operations other than maintenance of the time of day and the memory contents if the batteries become dangerously low. Whenever the batteries in the primary battery circuit **36** become low, a backup battery circuit **38** connects non-rechargeable backup batteries to power the organizer **10**. If a comparator within the primary battery circuit **36** determines that the primary batteries therein are almost out of sufficient charge, the regulator shuts down, and only the backup batteries within the backup battery circuit **38** are used. In that instance, the microcontroller **12** immediately stops all operations other than minimal maintenance to prevent loss of the memory contents. A battery charging circuit **40** provides a regulated current to the primary batteries in the primary battery circuit **36**, when an external charger is plugged into a charger jack **42**. The battery charging circuit **40** automatically senses when a charger is plugged into the jack **42** and signals the microcontroller **12** accordingly.

The DRAM **22** stores data which is generated as the user uses the organizer **10**. As shown in FIG. **3**, the DRAM **22** is divided into two basic storage areas. A first such area **44**, comprising the vast majority of the DRAM **22**, is used for voice recordings. The remainder of the DRAM **22**, as represented by a second area **46**, is divided into five separate areas. A first one **48** of the five areas is an "overhead" storage area used in the operation of the personal organizer **10**. The area **48** stores data used in maintaining the state of operation of the personal organizer **10**. The area **48** is of fixed size, and the various data fields thereof are also fixed within such area.

A second one **50** of the five areas within the storage area **46** is used to store voice templates which are created when the user trains the personal organizer **10** to his or her voice. Because the number of words stored for recognition purposes is known, the size of the area **50** is fixed.

A third one **52** of the five areas within the storage area **46** contains data pertaining to reminders and memos, which are described hereafter. The area **52** is divided into 255 small segments, one for each memo and reminder allowed. There is status information indicating whether the item is a reminder, recurring reminder, or memo, as well as an indication of which recording it is associated with. The time of recording a memo, or the due time for a reminder, and the period of recurrence for a recurring reminder, are also stored in this area. The storage area **52** is of fixed length.

A fourth one **54** of the five areas within the storage area **46** contains data pertaining to the phone directory, described hereafter. For each entry in the phone directory, there is space for two voice templates for the name, together with space for four phone numbers which may be up to 20 digits in length, and an indication of which recording is associated with the directory entry. This storage area is also of fixed length.

A fifth one **56** of the five areas in the storage area **46** comprises a data table used to indicate where in the voice recording memory space each recording resides. This table is similar to file allocation tables utilized in managing disc drives in small computers.

The voice recording storage area **44** is logically divided into fixed blocks **58** that are 512 bytes long. Only a few of the blocks **58** are shown in FIG. **3**, for simplicity of illustration. Each block **58** corresponds to approximately one-fourth second of recording time. Each recording is therefore a multiple of one-fourth second in length. As a recording is made, the starting one of the blocks **58** thereof is noted in the table. The data for each reminder, memo and the like "points" to a unique location in the table which "points" to a unique one of the blocks **58** in the voice recording area. As new recordings are made, the first available location in the table is assigned and the recording begins at the first available voice block **58**. As recording progresses past the first one-fourth second, the next available one of the blocks **58** is used to continue the recording. This block **58** may be the very next one or it may not be. At the end of each block is a "pointer" to the next one for this recording. If the block is the last one for the recording, the pointer indicates that this is the end of the recording.

When a recording is erased from the storage area **44**, it is only necessary to clear the entry thereof in the appropriate data area (memo/reminder or phone directory), clear the entry that was occupied thereby on the voice memory allocation table and mark the voice memory blocks **58** that were used, as being free. The voice data itself is not, in fact, erased. It is simply marked as "available", in the same manner as is done on discs in computers. Initially, recordings occupy contiguous groups of the blocks **58**. However, as the recordings are erased and others are made, the recordings tend to become fragmented across non-contiguous ones of the blocks **58**.

The internal RAM **16** within the microcontroller **12** is used to store information temporarily for fast access during each particular operation. For example, when voice recognition is to occur, the templates that are allowed for the particular item being accessed are pulled into the RAM **16**. This is necessary because access to the RAM **16** is significantly faster than for the DRAM **22**. As new operations proceed, the same memory space is reused for other purposes.

The microcontroller **12** operates to perform voice recognition in the same manner as described in the previously referred to copending applications, Ser. Nos. 07/915,112, 07/915,938 and 07/915,114. Such applications are incorporated herein by reference. As described in detail in co-pending application Ser. No. 07/915,112 for example, the A/D converter **18** may comprise an 8-bit converter which samples incoming data at a preassigned frequency such as 9.6 KHz. In that event, the A/D converter **18** outputs a digital signal representing the input analog voice signal. A microprocessor (MP) **62** within the microcontroller **12** processes the digital voice signal together with a voice recognition software routine forming part of a control program stored in the ROM **14**. The digital voice signal is converted into an incoming voice template that is compared against previously stored voice templates of the user's voice, stored in the external DRAM **22**. The program decodes the voice templates. Together with the external DRAM **22**, the RAM **16** comprises a reference memory for temporary storage of data.

Thus, the analog voice signal is applied to the A/D converter **18** for conversion into an incoming digital voice signal. The reference memory, comprised of the DRAM **22** in conjunction with the RAM **16**, stores a plurality of reference digital voice templates. The ROM **14** stores the control program. The microprocessor **62** which is coupled to the A/D converter **18**, the ROM **14** and the RAM **16** generates an incoming digital voice template from the incoming digital voice signal at the output of the A/D converter **18**. The microprocessor **62** then executes the control program to determine whether the incoming digital voice template is substantially equivalent to one of the reference digital voice templates, stored in the reference memory comprised of the RAM **16** and the external DRAM **22**. The microprocessor **62** determines what action to take corresponding to a reference digital voice template, if the incoming digital voice template is found to have substantial similarity to the reference digital voice template.

Voice control is made possible by first voice training the collection of reference digital voice templates in accordance with the user's voice. Such templates are collected in the same manner as described in co-pending application Ser. No. 07/915,112. When voice training is complete, the personal organizer **10** is ready for use.

IDLE MODE/SELECT (FIG. 4)

The basic program for the organizer **10** begins with an idle mode/select operation mode software routine, shown in the flow diagram of FIG. **4**. When in such idle mode, as represented by a block **64**, the clock and calendar are displayed by the LCD **20** as shown in FIG. **2**. As shown in FIG. **4**, various different operations may take place from the idle mode **64**, including memo record **66**, calendar (voice access) **68**, phone directory **70**, memo review (play last memo) **72**, voice training **74**, set clock **76**, waiting message **78**, and security **80**.

As shown in FIG. **4**, by pressing the silent button from the idle mode **64** memo review **72** may be selected, in which event the last memo is selected. Selection may also be made of reminder review **84**, in which event the first reminder is selected. Further selections include recurring reminder review **86**, in which event the first recurring reminder is selected, calendar **88**, with today being selected, and calculator **90**. The memo review **72**, the reminder review **84** and the recurring reminder review **86** modes are described hereafter in connection with the flow diagram of FIG. **11**.

As previously noted, the idle mode **64** shown in the flow diagram of FIG. **4** includes display of the current time of day, the date, and the day of the week, using the LCD **20**. All operations other than those necessary to maintain the time of day, the memory contents, and to monitor the key states, are disabled, to minimize drain on the batteries. The idle mode **64** is exited if a key of the keypad **34** is pressed or if a reminder time comes due.

Typically, the first thing a user does with the organizer **10** is to set the clock to the current time and date (set clock **76**) and then train the organizer to his or her voice (voice training **74**). Once these items are completed, all other features will be fully operational. Until the voice training is completed, none of the voice recognition features will operate. Instead, they will result in a message "TRAIN" being displayed, to prompt the user to complete voice training.

SET CLOCK (FIG. 5)

The set clock function **76** of FIG. **4** is shown in detail in the flow diagram of FIG. **5**. The user begins by holding the "edit" button for two seconds while in the idle mode **64**. A simple press of the "edit" button results in a single beep being generated by the personal organizer **10**, and this is used for editing. To prevent the clock setting procedure from inadvertently being initiated, the user must hold the "edit" button for a full 2 seconds until a subsequent double beep is heard. At this point, the current time and date are displayed with the hour field blinking. The user then presses the "next" button to advance the hour by one or the "prev" button to decrease the hour by one. When the correct hour is displayed (including AM or PM), the user presses the "edit" button to again move to the day field. The day field is edited in the same manner. The user again presses the "edit" button to move to the next fields, namely month, day and year, using the "next" and the "pref" buttons to change the entries, until the entire date and time are entered. At any point, the user can press the "save" button to accept the date and time as entered, or the "stop" button to revert to the time and date that were set before the user began the operation.

Thus, as shown in FIG. **5**, pressing of the "edit" button for at least two seconds, while in the idle mode **64**, initiates a series of operations including set hours **92**, set minutes **94**, set month **96**, set day **98**, set year **100**, and display all **102**. During each of the operations **92**, **94**, **96**, **98**, **100** and **102**, pressing of the "next" button advances the display by one, while pressing of the "prev" button decreases the display by one. Each pressing of the "edit" button moves to the next field or operation along the chain of operations **92**, **94**, **96**, **98**, **100** and **102** for editing thereof. Pressing of the "save" button accepts the date and time as entered, as represented by a save time/date block **101**. Pressing of the "stop" button reverts to the time and date that were set before the user began the operation, as represented by a no change block **103**.

VOICE TRAINING (FIG. 6)

The voice training function **74** of FIG. **4** is shown in detail by the flow diagram of FIG. **6**. Voice training is initiated by

pressing the "train" button while in the idle mode **64**. If the user has not yet performed initial complete training, then complete training is begun. Otherwise, a "train one-word" process is begun.

Upon commencement of initial complete training, as determined in a step **104** in FIG. **6**, the first word of the training list is displayed. The user holds the "time" button and speaks the word which is displayed. The template of the spoken word is stored, and the next word is displayed, in a step **106**. The process continues until the last word is stored in this manner, as determined in a step **108**.

When the template for the last word in the list is collected, a second template for each word is collected in the same order, as determined in a step **110**. The collected template is compared to the previously collected template, in a step **112**. If the template compares best with the previous template for the same word, as determined in a step **114**, then it is saved and the organizer **10** progresses to the next template. If it does not match the previous template for this word, then the user is asked to repeat the word for collecting a third template, in a step **116**. The process repeats until there are two templates for each word that match. When this has been accomplished for all words in the list, the organizer **10** returns to the idle mode **64**, in a step **118**.

If the train mode is entered when there are existing templates, then the user may train a word of his or her choice, as represented by a step **120**. This is useful to correct problem words that are not being recognized properly. The user presses either the "next" or the "prev" button to scroll through the list of words. When the word the user wants is displayed, the user proceeds to hold the "time" button and collect two templates, as represented in steps **122**, **124**, **126**, **128** and **130**.

If the user wants to completely retrain all templates, then after entering the train mode, the user holds the "erase" button until a double beep is heard, as represented by a step **132**. All templates are erased and the complete training process is initiated.

MEMO RECORD (FIG. 7)

Memo recording can be accessed from several states in the overall program flow, as shown in the memo record flow diagram of FIG. **7**. At these points in the program flow, the user holds the "record" button and speaks into the organizer **10**. The microcontroller **12** activates the analog circuitry including the voice compression and decompression circuit **28**, and begins to store the incoming recording data in the DRAM **22**. This is represented in a step **134** in FIG. **7**, in association with the idle mode **64**, the memo review **72**, the reminder review **84**, the recurring reminder review **86**, and the calendar **88**. If the "record" button is released before 0.75 seconds has elapsed (i.e., before three of the blocks **58** shown in FIG. **3** are filled), then the recording is "erased" automatically and the idle mode is returned to, as represented by a step **136** in FIG. **7**. Conversely, if the recording is longer than 0.75 seconds, then the recording is added to the data memory and the memo review mode **72** is returned to with the new memo selected, as represented by a step **138**. The 0.75 second minimum time is implemented to prevent unintentional "silent" memos from being recorded due to accidental pressing of the "record" button.

REMINDER SETTING (FIG. 8)

Reminders are built on memos. A due time (alarm time) is added to a memo by the user. When the due time arrives, the organizer **10** alerts the user with a short series of beeps, as described hereafter. When a memo is recorded, it can immediately be turned into a reminder. A memo may also be turned into a reminder at any later time, simply by selecting the memo.

FIG. **8** is a flow diagram of the reminder setting, which shows the process of creating a reminder. The user begins by selecting the memo to be made into a reminder (or an existing reminder for which a new due time is desired) and then holding the "time" button, as represented by a step **140**. The organizer **10** then prompts the user for the information needed, so that the user does not have to remember the exact procedure required. First of all, the current time and day are displayed with the hours field blinking to indicate that the user should speak the hour. See the display shown in FIG. **19A**. If the user speaks the word "timer", then the process changes to a timer input, as described below. For a reminder, the user recites the number for the hour desired (1–12), in a step **142**. The hour recognized is displayed and the minutes field along with the AM/PM is selected and proceeds to blink, as shown in FIG. **19B**. This is represented by a step **144** in FIG. **8**. The user may state either a one-fourth hour (15, 30 or 45) or "AM" or "PM" if the desired time is on the correct hour. If a one-fourth hour is stated, then the AM/PM which is chosen blinks, and the user must state either "AM" or "PM". This is represented in a step **145**.

At this point, the time setting is complete. During the preceding entry process, and for the remaining data entry, there is a 0.5 second time-out that will occur if the user releases the "time" button. If the user releases the "time" button for longer than 0.5 seconds, then the reminder time is either saved as entered or, if the entered data is incomplete, then no change is made and the item reverts back to its former state, as represented by a step **146**. The minimum entry required is as previously described, up to and including AM/PM.

If the user stops after AM/PM entry, then the reminder is saved and said to alert the user at the next occurrence of the time entered (either later today or the next day).

The user may continue to hold the "time" button and enter a day or date, as represented in a step **148**. At this time, the day field blinks and "DAY-DATE" is displayed to indicate to the user that either a day (Sunday through Saturday) or an entire date (11/25 for example) may be entered, as shown in the display of FIG. **19C**. The user may also say the word "recurring" at this point, to make a daily recurring reminder, as discussed below. If a day of the week is recognized, then date entry is completed and the reminder will alert the user at the next occurrence of the time and day entered.

If a number is entered, it is placed in the month field and the day field continues to blink, as shown in FIG. **19D**. The user proceeds to enter the day of the month, one digit at a time. If the day is the 1st through the 9th, then the user stops after speaking one digit. If the day is 10 or greater, the user must speak each digit individually. Unless the date requested is invalid, the reminder is saved as entered, as shown in the display of FIG. **19E**.

At the end of any valid time/date entry, the user may say the word "recurring". The reminder is thereby made a recurring type reminder, and a period of recurrence is assigned based on the amount of information entered. If the user stops after entering AM or PM, the word "daily" is displayed and blinks. If a day of the week was entered, the word "weekly" is displayed and blinks. If the entire date was entered, then the word "monthly" is displayed and blinks. The user can press the "next" or "prev" buttons to scroll the allowable periods (daily, weekly, monthly or yearly). When

the desired period is displayed, the user can press the "save" button to record this entry, or wait for a 10-second time-out to automatically save it.

The day portion of a date entry is represented in steps **150** and **156**. The "recurring" functions are represented in steps **152, 154, 156** and **158**. Each of these steps involves spoken words (shown in quotes) or a time-out, as described above.

MANUAL ENTRY (FIG. 9)

The user may use a manual method of entering a reminder time/date rather than voice input. Manual entry, as shown in the flow diagram of FIG. **9**, begins with the pressing of the "edit" button. The process is similar to that for setting the clock time previously described. Namely, the user scrolls through the choices for each field, using the "next" and the "prev" buttons to increase or decrease each field by one. The user moves on to the next field by pressing the "select" button.

Thus, as shown in FIG. **9**, the pressing of the "edit" button after recording a memo or with a memo or reminder selected, begins the manual entry process as represented by a step **170**. The hour field is entered for editing, as represented by a step **172**. The editing process begins at the current time, and the "next" and "prev" buttons are used to increase or decrease the hour by one, respectively. Pressing of the "select" button moves to the edit minutes field as represented by a step **174**. Following editing of the minutes, again using the "next" or "prev" buttons, the user uses the "select" button to advance to the edit months field, as represented by a step **176**, and then to an edit day field as represented by a step **178**. Pressing of the "select" button one more time returns to the step **172**.

As with voice entry, only complete and valid entries are saved. Invalid or incomplete entries revert to their former state. Once a valid entry is inputted, the user can hold the "edit" button for a double beep to make this a recurring reminder. The user can then choose the period of recurrence in the same manner as is done for voice input. As represented by a step **180** in FIG. **9**, pressing of the "save" button in any of the steps **172, 174, 176** or **178** saves the reminder by going to reminder review with the reminder selected. Pressing of the "stop" button within any of the steps **172, 174, 176** and **178** indicates no change, in which event the system goes to memo or reminder review with the item selected, as represented by a step **182**.

TIMERS (FIG. 10)

Timers are a variation of reminders. The user can set a timer to go off in a period of time measured from the moment the timer is set, up to 23 hours and 59 minutes.

A timer setting is begun with the user saying the word "timer" as the first word in setting a reminder. The process is shown in the flow diagram of FIG. **10**. From the reminder setting flow diagram of FIG. **8**, which is represented by a block **190**, saying the word "timer" leads to a step **192** in which the user states a one- or two-digit number, and follows it by stating "hour", "hours" or "minutes" as represented in steps **194, 195, 197, 198, 199** and **201**. If the user sets a number of hours first, the user can follow with a second one- or two-digit number, followed by stating "minutes".

As with reminders, when the "time" button is released, there is a 0.5 second time-out after which the timer is saved. As shown in FIG. **10**, a time-out with an incomplete entry results in a no change step **196**, in which event the system goes to memo or reminder review with the item selected. On the other hand, a time-out with a complete entry at steps **197** or **205** results in a save reminder step **203**.

After the user states "hour", "hours" or "minutes", the user may proceed to state "recurring". A recurring timer alerts the user with a period of recurrence equal to the timer setting. For example, if the timer is set for 8 hours, the user is alerted every 8 hours from the time that the timer is set.

Manual entry for the timer is initiated for manual entry of a reminder. After pressing the "edit" button to start manual entry, the user presses "edit" again to change to the timer format. As with reminders, the user presses "next" or "prev" to set the desired number for each field, and presses "select" to move from the field. In this case, there are only two fields, hours and minutes. A timer can be made recurring manually by holding the "edit" button for a double beep.

MESSAGE REVIEW (FIG. 11)

As described in connection with the idle mode/select flow diagram of FIG. **4**, the user can review his or her messages by type, in terms of memos, reminders and recurring reminders. As represented by a block **200**, in FIG. **11** which is a message review flow diagram, the user may press the "select" button to reach the desired category. From the idle mode (clock display), the user presses once to get to memos, twice to get to reminders and three times to get to recurring reminders. There is also a shortcut for memos from the idle mode, achieved by the user pressing "play" with the memo category being selected and the last memo recorded being automatically played back.

When the memo category is selected, the last memo to be recorded is defaulted to. Because memos are numbered in the order that they are recorded, such memo will be the Nth memo, where N is the number of memos presently saved. When the reminder or recurring reminder categories are selected, the next reminder or recurring reminder to come due (i.e., **1**) is defaulted to. The message review flow diagram of FIG. **11** demonstrates this process.

Once the category is selected, the user has many options. Pressing "stop" exits back to the idle mode. Pressing "select" proceeds to the next category. Pressing the "record" button begins the recording of a new memo. Pressing the "time" button sets a reminder time for the message selected. Pressing the "edit" button begins manual entry or editing of a reminder time. Holding the "erase" button for a double beep erases the message.

Only the "play", "prev" and "next" buttons are used for actual review of the messages. The user presses "play" to play back the selected message. Pressing "next" advances to the next message, automatically playing it. Pressing the "prev" button moves to the previous message, automatically playing it. The user does not have to wait until the playback of a message is complete before moving to the next or the previous message. Pressing the "next" or "prev" button during playback aborts the playback and moves to the next or previous message, automatically playing it back. The selection of messages "wraps around". In other words, if the last memo is selected, pressing "next" moves to the first memo. Likewise, if the first one is selected, pressing "prev" moves to the last one.

While a message is being played back, the user can press the "stop" button to pause the playback. The user presses "play" to resume playback where it was paused. Pressing "stop" while playback is paused will cause the "pause" display to be removed and the current memo to still be selected. Pressing "play" at this point starts playback from

the beginning of the message. Any time a message is displayed but is not being played back and is not paused, the user can press "stop" to return to the idle mode.

At any point in the review process where a message is not being played back, there is a 30-second time-out that causes the same action that would occur if the stop button were pressed. The flow diagram of FIG. **11** applies to memo review, reminder review, and recurring reminder review. When entered using the "select" button, the last recorded memo or next reminder or recurring reminder to come due is defaulted to. When entered by creation/editing of a message, that message is defaulted to. As noted, message numbers are assigned and messages are reviewed chronologically. Memos are done by the time recorded, while reminders and recurring reminders are done by the time that they are to come due. Timers and recurring timers show count-down to the time they will come due. The text displayed depends on the message type. Memos display "RECORDED", reminders display "PLAYBACK", timers display "PLAY IN", recurring reminders display "DAILY", "WEEKLY", "MONTHLY", or "YEARLY".

From the block **200** of FIG. **11**, pressing the "stop" button reaches the idle mode **64**. Pressing the "select" button results in selection of the next category, represented by a step **202**. Pressing the "record" button results in memo record **66**. Pressing the "time" button sets a new time, as represented by a step **204**. Pressing the "edit" button sets the new time manually, as represented by a step **206**.

From the block **200**, pressing of the "play" button results in playing of the message, as represented by a step **208**. Pressing of the "next" button proceeds to the play step **208** through a step **210** in which the next message is selected. Pressing the previous or "prev" button proceeds to the playing step **208** through a step **212** in which the previous message is selected. Pressing of the "stop" button results in the pause of playback, as represented by a step **214**. Pressing the "play" button continues playback, as represented by a step **216**. At this point, however, pressing of "stop" returns to the block **200**. Pressing of "erase" at any of the various steps results in erasure of the message and selection of the next message, as represented in a step **218**.

WAITING MESSAGES (FIG. 12)

Whenever a reminder or a recurring reminder (including timers) comes due, the organizer **10** generates a short sequence of beeps to alert the user. The user is locked out of all other operations until he or she either listens to all waiting messages or defers them. If the user does not respond, the beep sequence repeats as follows:

1. Every 5 minutes until 15 minutes past due.
2. Every 15 minutes until 2 hours past due.
3. Every hour until 12 hours past due.
4. After 12 hours, there is no more beeping.

This is shown in FIG. **12** which is the waiting message flow diagram.

As shown in FIG. **12**, from the idle mode **64** a step **230** occurs when a reminder comes due. There are seven sets of two beeps, 0.5 seconds apart. After the beeps have occurred, the word "MESSAGE" is displayed and blinks, as represented by a step **232**. The "message" display is shown in FIG. **19F**. Every time a minute passes, the organizer **10** automatically checks to see if other messages have come due, as represented in a step **234**. If one or more messages have come due, then the organizer **10** beeps again, updates the number of messages on the display and returns to the "message" display. When this display occurs, the user has two options.

Typically, the user will press the "play" button to begin review of the waiting message or messages, as represented in a step **236**. The display is shown in FIG. **19G**. As each waiting message is played, the user can use the "next" and "prev" buttons to move from message to message. The only difference between review of waiting messages and review of messages that have not come due is that, for waiting messages, there is no automatic playing of the message when the "next" or "prev" buttons are pressed. Selection of the next waiting message by pressing of the "next" button is represented in a step **238**. Selection of the previous waiting message by pressing the "prev" button is represented by a step **240**.

The user can also set a new playback time for a reminder after reviewing it. This is done by either holding the "time" button and entering a due time by voice, as represented by a step **242**, or by pressing the "edit" button and entering the new time manually, as represented by a step **244**.

When playback of a message is completed, there is a 30-second time-out after which the review process is exited. Pressing the "stop" button has the same effect. Upon exiting the review mode, if there are still messages that have come due that have not been reviewed, the "MESSAGE" display is returned. If all waiting messages have been reviewed, then the idle mode **64** is returned to.

A second option which the user has is to defer the waiting messages by pressing the "stop" button. This effectively sets all of the waiting reminders to occur again in 15 minutes, thereby freeing the features of the organizer **10** for user access. Deferring is represented by a step **248**. If the user wishes to defer for a different period of time, he or she holds the "stop" until a double beep is heard, as represented in a step **246**, and "SET DEFER" is displayed. The user then keys in a new defer period in the same way that a timer is set manually.

The user may also change the default deferral time of 15 minutes by holding the "time" button for a double beep at the idle clock display and setting a new default defer time in the same manner.

As noted, from the play message step **236**, pressing of the "erase" button erases the reminder, in a step **250**. Pressing the "save" button saves the recording as a memo, as represented in a step **252**. Pressing "stop" deletes reviewed reminders that have not been saved, as represented in a step **254**. Inactivity for 30 seconds has the same effect, in this instance, as pressing the "stop" button. In the step **254**, recurring reminders are not automatically deleted. Whether or not there are unreviewed waiting reminders is represented by a step **256**.

CALENDAR (FIG. 13)

The calendar mode, as shown in the flow diagram of FIG. **13**, allows the user to review all of the reminders and recurring reminders for a single day combined. As shown in the idle mode flow diagram of FIG. **4**, there are two ways to access the calendar.

The calendar may be accessed by pressing the "select" button as represented in a step **270**. The calendar follows the review of recurring reminders in the select process. When the calendar is selected, the display, as represented by a block **272** shows the present date and the day and the number of reminders and recurring reminders for that day. The user can either press the "next" button to move forward to another day, as represented in a step **274**, or hold the

"time" button and speak a day or date, as represented in a step **276** to go to another day. When at another day, the user can use the "next" or "prev" buttons to move around from day to day, or the user can hold the "time" button to do so by voice. Moving to the previous day by pressing the "prev" button is represented in a step **278**. Holding of the "time" button provides a shortcut from the idle mode. The user simply holds the "time" button and states the day or date desired.

The only dates shown for the calendar are from the present day to a year in the future (less one day). Scrolling with the "next" and "prev" buttons stops at these extremes. By voice, the days of the week cause the calendar to "jump" to today or one of the following six days. A date is entered in the same manner as is done for reminders. The numbers 1–12 are used for the month, followed by a one- or two-digit day. This is represented by steps **280**, **282**, **284**, **286** and **288**.

When the day desired by the user has been selected, the user may press "play" to effectively enter the day, beginning with the playing back of the first reminder or recurring reminder to come due on that day, as represented in a step **290**, and with the due time and other data shown on the display as is done in the review of messages previously described. In this case, the messages begin with the first one through the number due for that day, according to the time that they are due. The user moves from message to message, using the "prev" and "next" buttons. The newly-selected message is automatically played back in the usual fashion.

When the user is finished reviewing the messages for a particular day, pressing of the "stop" button returns to the display of the date and day, thereby allowing the user to select another day, as before.

PHONE GROUP SELECT (FIG. 14)

The phone directory is accessed for both input and output using the "phone" button, primarily. To optimize voice recognition, several alphabetical groups are assigned. Each name is input into one of the alphabetical groups and is retrieved from the same group. The groups are chosen for equal average utilization. For example, five groups of twenty names are alphabetically divided as follows: A–D, E–I, J–M, N–R and S–Z.

This is shown in the phone group select flow diagram of FIG. **14**, which illustrates the manner in which the individual alphabetical groups are accessed. From the idle mode **64**, the user presses the "phone" button multiple times to cycle through five different alphabetical groups of names **292**, **294**, **296**, **298** and **300**. For example, one press of the "phone" button accesses the A–D group **292**. A further press of the button accesses the E–I group **294**. Any time the "stop" button is pressed or a time-out occurs, the phone directory is exited.

PHONE NUMBER RETRIEVAL (FIG. 15)

FIG. **15** is a flow diagram for the phone number retrieval process, which accesses phone numbers already entered into the directory. From the idle mode **64**, the alphabetical groups are displayed in a start step **310**, and pressing of the "phone" button advances through the various alphabetical groups, as represented by a step **312** in FIG. **15**. This takes place as previously described in connection with FIG. **14**. The most common use of the phone directory involves holding the "phone" button down once the desired group is displayed, and speaking the name desired. This is represented by a step **314**. When the name is recognized, the first number associated with the name is displayed. If the user wants another number associated with this name, the user presses the "next" key to get the next number, in steps **320** and **328**. If there is no next number for the name, the next name in the directory is accessed, in a step **330**. Every time a number is accessed, the recording associated with the directory entry is played back to confirm the name selected. The number is displayed at the same time, as represented by a step **318**. Pressing the "play" button from the start step **310** selects the first number for the first entry, as represented by a step **318**, for playback recording in the step **316**.

From the step **316**, the user can navigate manually through the directory using the "next" and "prev" buttons, as represented by steps **320** and **322**. From the alphabetical group display, the user can access the directory without ever speaking a name by pressing the "play" button. This accesses the first number of the first name in the directory, as represented in the step **318**. Any time a number is displayed, pressing the "play" button results in replay of the recording for that entry.

At the number display, represented by the step **316**, the user may press the "stop" button to return to the alphabetical group display, via the start step **310**, or press and release the "phone" button to go to the next group, as represented by the step **312**.

The user may also perform editing features at the number display of the step **316**. The user can retrain the templates for better recognition by pressing the "train" button to retrain the name in a step **324**. This will initiate the same training sequence that was performed when the number was entered. The new templates replace the old templates, once the retraining is completed. If the user presses the "edit" button, as represented by a step **326**, the first digit of the displayed phone number blinks and the user can change it using the "next" and "prev" buttons, as has been described for other manual entry. The user advances from digit to digit while editing, by pressing the "select" button. The recording for the selected entry can be replaced by holding the "record" button for a double beep and speaking the new utterance to be recorded, in a step **327**.

Another number may be added to an entry by holding the "edit" button for a double beep as represented in a step **336** with a number associated with the desired entry being displayed. If the "edit" button is held for a double beep while an alphabetical group is displayed, then a new entry is made. If a new name is being added to the directory, the "edit" button is held at the alphabetical group display at the start step **310**. If the group is full, an error message is displayed briefly and the group display is returned. If the group is not full, the screen prompts the user for the name. The user holds the "phone" button and speaks the name, repeating as prompted. Once the name is trained, the display prompts for the number. (If the "edit" button was held while a phone number is displayed and there are not four numbers already associated with this entry, then a new number is added starting at this point in the flow.) The user continues to hold the "phone" button and enters the phone number, one digit at a time.

When the user is finished entering the phone number, he or she presses the "save" button to indicate completion. This is necessary to allow for a variable length phone number (i.e., with area codes or without, and international numbers). The user then selects which of the four types of phone numbers is present; business, home, fax or other. Only those not already filled for this entry are presented to the user, who chooses using the "next" and "prev" buttons, and terminates by pressing the "save" button again.

The display then prompts the user to record a message. Typically, the message will simply be the name of the person, although a more detailed message may be recorded with other information. This recording is played back any time any of the numbers associated with this entry are played.

ADD PHONE NUMBER (FIG. 16)

The process of adding a phone number to the directory, as just described, is shown in the flow diagram of FIG. **16**. The alphabetical group display of the start step **310** of FIG. **15** is represented by a step **350** in FIG. **16**. Holding the "edit" button for a double beep reaches a step **352** to determine if there are already twenty entries in the directory. If so, then the step **350** is returned to via a step **354**. If not, then first and second name templates are collected in steps **356** and **358**, and the phone number is input in a step **360**. The template collection process is the same as that used for training, as previously described, except that the "phone" button is held for input and repeat of the second collection as necessary. A time-out during the steps **356**, **358** and **360** or pushing of the "stop" button during the step **360** causes return to the alphabetical group display step **350**.

From the step **360**, pushing the "save" button advances to a step **362** to select the type of phone number such as business, home, fax or other. From the step **362**, a time-out results in an accept default step **364**. After release of the "phone" button, the time-out period for template collection is 0.5 seconds. All other time-outs result after 30 seconds of inactivity.

From the step **362** or the step **364**, recording is performed in a step **366**. Recordings are done by holding the "phone" button or the "record" button. Again, pressing the "stop" button at either of the steps **362** and **366** returns to the alphabetical group display step **350**. Once recording in step **366** is completed, the phone number is displayed, as represented by a step **368**.

If the process is started by holding the "edit" button from a phone number display rather than an alphabetical group display, then the template collection is bypassed and a new number is added to the entry already selected. A step **370** determines whether or not there are four numbers already associated with an entry. If there are not four numbers already associated with the entry, then the new number is added starting at this point in the flow, via the step **360**.

SECURITY (FIG. 17)

The security mode allows the user to lock-out all operations of the organizer **10** until a secret 4-digit code is entered. The security mode is accessed from the clock display of the idle mode **64** by holding the "select" button for a double beep. The first time that this is done by the user, the only activity permitted is establishment of a security code. Any other activity returns to a "SECURITY OFF" display in a step **380**. To establish a code, the user holds the "edit" button for a double beep and then enters a 4-digit code in a step **404**. Entry by voice is done by holding the "time" button and speaking four digits, each in the 0–9 range. Entry is done manually by pressing the "edit" button and then using the "next", "prev" and "select" buttons as for other manual functions. Once entry is complete, the "SECURITY OFF" display is returned, at the step **380**.

With the code established, the user can move from the "SECURITY OFF" display, in step **380**, to a code entry display for activating security. This is done by pressing the "select" button, in a step **386**. With a security code having been established, the code entry is displayed, to turn security on, in a step **388**. The user then holds the "time" button and speaks the four digits of the code in a step **390**. Alternatively, the user can press the "edit" button and proceed with manual entry, in a step **392**, as in the case of the step **384**.

If the code entry is correct, the display momentarily shows the "SECUR ON" and then returns to the idle mode, but with security activated, in steps **394** and **396**. If the entry is incorrect, the display shows "WRONG" and the unit is locked-up for 30 seconds, in a step **398**.

Once security is activated, any keypress will go directly to the code entry display for entry of the code to deactivate security, as represented by a step **400**. The user enters the code as previously described. If the entry is correct, the display shows "SECURITY OFF" and then returns to the idle mode, via a step **402**.

When security is off, the user can change the security code by holding the "edit" for a double beep from the "SECURITY OFF" display **380**. The user is asked to enter the old code. If the entry is correct, then the user is asked to enter a new code, via a step **404**. New code entry can be performed by voice or Manually, as with other code entries. Any time the user enters an incorrect code, the system locks up for 30 seconds while displaying "WRONG" and then returns to the idle mode **64**, as represented in steps **408** and **398**.

"NO" LOGIC (FIG. 18)

Any time a voice recognition feature is used, the user has a means to correct for a misrecognized word. When the display shows a number or word that was not the word the user spoke, the user may subsequently say "no" while still holding the "time" (or "phone") button. This is shown in the "no" logic flow diagram of FIG. **18**. At this point, the organizer **10** displays the word or number that scored second highest during the recognition process. If this is still not correct, the user may say "no" again. This time, the organizer **10** back-spaces over the entry and encourages the user to repeat the word. If the word is still misrecognized, the user may continue saying "no" and this process will iterate, with the second best guess being followed by repeating the word. Once the user is satisfied that the number or word displayed is correct, the user continues on with the next word or number desired.

This is shown in the flow diagram of FIG. **18** with a speech input at a step **420**. This results in displaying of the word or number with the highest score, in a step **422**. This is followed by speech input for the next item or the end of speech input, in a next step **424**. If the user enters "no" then the word or number with the second highest score is displayed, in a step **426**. Otherwise, the word or number for the next item is displayed, or speech input is exited in a step **428**.

Following display of the word or number with the second highest score, in the step **426**, speech input for the next item is entered or is ended, in a step **430**. At this point, if the user speaks "no", then "REPEAT" is displayed, in a step **432**, and the system returns to the step **420**. Otherwise, the step **428** is advanced to.

The utilization of voice recording and voice recognition technology, in voice-activated personal organizers **10** in accordance with the invention, allows the size of the organizer **10** to be much smaller than manually-operated devices. The particular implementation of the organizer **10** shown in FIG. **2** is somewhat oval in shape so as to comfortably fit into the palm of the user's hand in such a way that the

organizer **10** can be operated with one hand. The "record" and "time" buttons are on the corners immediately accessible by the user's thumb and forefinger. The "phone" and "select" buttons are on the top, between such buttons. These four buttons are the most-used buttons.

The "play", "next", "play" and "stop" buttons are on the face of the organizer **10**, below the LCD display **20**, and in a diamond-shaped arrangement. These buttons carry the universal symbols used in tape players and similar devices. The four least used buttons are the "train", "save", "erase" and "edit" buttons These buttons appear below the "play", "next", "play", and "stop" buttons.

The microphone **24** and the speaker **32** are located behind the buttons on the face of the organizer **10**, and face in the same direction as in the LCD display **20**. This ensures proper alignment when the user places the unit for easy viewing of the display **20**.

It will be appreciated by those skilled in the art that variations and alternatives are possible in accordance with the invention. For example, the organizer **10** can be embodied in a form more closely related to that of a standard organizer with a small keypad for entering some text that is beyond current voice recognition technology, such as addresses. In such instances, the use of voice recognition technology for most input would make it feasible to use a smaller keyboard (and thus a smaller physical unit), without making the organizer difficult for the user. Such an organizer can have a larger display, thereby allowing for more complex messages of the type used in larger organizers. Such complex images can include, for example, a full week calendar showing appointments "blocked out" or names with addresses and phone numbers. This variation provides the user with the benefits of a more natural interface using voice for recordings and recognition, together with the ability to input more complex information using a keyboard when necessary.

Still other variations of the organizer **10** in accordance with the invention can be implemented in a physical form similar to that shown in FIG. **2**, but with some of the software features being changed. For example, an expense logging and reporting feature can be added with no change to the physical or electrical implementation. In such a case, the user can access the expense feature in the same way as the calendar described herein. The user either presses the "select" button several times to access expenses manually, or presses the "time" button (probably renamed "voice" for this application) and says the word "expenses." After entering the expenses category, the user can speak the name of a category such as "air fare", "car rental", "entertainment", "hotel", "meals", "mileage", "phone", or the like. To add an expense item, the user continues to hold the "voice" button and speaks a dollar value, one digit at a time, such as "two . . . one . . . point . . . seven . . . five" for $21.75. Once the entry is completed, the user can record a comment to be attached to such entry, in the same way that a recording is attached to a phone directory entry. When the item is saved, it is tagged with the current time and date. For retrieval of information, the user holds the "voice" button and says the word "expenses" followed by the name of a category. Instead of continuing to speak, the user releases the "voice" button. The organizer then shows the total number of items recorded for this category. At this point, the organizer functions in much the same way as in the case of the calendar feature described above. The user presses the "play" button to start review of the entries, one by one, for this category in chronological order, moving from entry to entry using the "next" and "prev" buttons. At the end of all entries is the total for such entries, so that the user does not have to add up all the entries by himself or herself.

When finished with the entries in a category, the user presses the "stop" button to return to the category display, and then uses the "next" and "prev" buttons to move to another category or "stop" (again), to exit. In this way, the user can easily review all entries in each category for filling out an expense report, and the like. A special "category" is available by voice or manually. For example, for a total, the user either speaks the word "total" or manually advances through all the standard categories to arrive at the total which will display the grand total of all entries in the expense categories.

Another special "category" is "date". If the user says the word "date" instead of a category, the review is by date, much in the manner of the calendar feature described above, rather than by category as also previously described. Other than this difference, the user interface is the same.

Still other features and variations are possible in accordance with the invention. The common features of voice recognition and voice recording technologies provide for a more comfortable and familiar interface for the user. Such common features also allow for the implementations to be more comfortable in size, particularly in terms of making such implementations smaller. Such improvements over present technology allow for such personal information devices to be more personal and easy to use and, therefore, to better serve the primary purpose of this type of device. Consequently, such devices comprise easily carried and easily used means of storing and retrieving commonly needed information.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. An electronic organizer comprising:

a first transducer for converting acoustic sound energy representing spoken words into an electrical speech signal;

a coupling circuit having an input for receiving the electrical speech signals and first and second outputs each for providing a respective output signal corresponding to the electrical speech signal;

recording means coupled to said first output for recording an output signal in a form to permit reproduction of the corresponding electrical speech signals;

word identifying means coupled to said second output for identifying a spoken word from among a selected plurality of spoken words;

data storage means coupled to said word identifying means for storing data corresponding to each identified spoken word;

function selection means including a plurality of manually operable function selection members; and

control means coupled to said recording means, said word identifying means, said data storage means and said function selecting means for causing an output signal at said first output to be recorded by said recording means in response to manual operation of a first one of said function selection members, and for causing said word identifying means to identify, and said data storage means to store data corresponding to, at least one spoken word which is spoken following manual opera-

tion of a second one of said function selection members, said control means being responsive to sequential operations of the first and second ones of said function selection members for associating an output signal recorded by said recording means in response to the operation of the first one of said function selection members with the stored data corresponding to the at least one word spoken following the operation of the second one of said function selection members, wherein said coupling circuit is operative for subjecting the received electrical speech signals to a first processing that modifies the received electrical speech signals for speech recording and supplying signals which have undergone the first processing to said first output, and for subjecting received electrical speech signals to a second processing, different from the first processing, that modifies the received electrical speech signals for identification by said word identifying means and supplying signals which have undergone the second processing to the second output.

2. An electronic organizer in accordance with claim 1 wherein there are a plurality of types of data each associated with a group of selected spoken words that can be identified by said word identifying means, said function selection means are operable for selecting at least one of the types of data, said organizer further comprises a visual display having a plurality of display regions each associated with a respective one of the types of data, and said control means are coupled to said visual display for causing a readable representation of a spoken word identified by said word identifying means to be displayed in a display region associated with one of the types of data in response to operation of said function selection means to select the at least one of the types of data.

3. An electronic organizer in accordance with claim 1 wherein said control means are operative, in response to selection of one of the types of data by said function selection means, for causing said visual display to produce a distinctive visual indication in the display region associated with the selected one of the types of data, which visual indication informs a user of the type of data for which a word is to be spoken.

4. An electronic organizer in accordance with claim 2 when said control means are operative in response to operation of said second one of said function selection members for causing said visual display to produce a distinctive visual indication in a first one of the display regions until said word identifying means has identified a spoken word associated with the same type of data as said first one of said display regions, and for causing said visual display to produce a distinctive visual indication in a second one of the display regions in response to identification by said word identifying means has identified a spoken word associated with the same type of data as said first one of said display regions.

5. An electronic organizer in accordance with claim 1 further comprising a second transducer for converting signals recorded in said recording means into audible speech signals and a visual display for producing readable representations of data stored in said data storage means, and wherein said control means are coupled to said second transducer and to said visual display for outputting signals recorded in said recording means only to said second transducer and for outputting signals based on data stored in said data storage means only to said visual display.

6. An electronic organizer in accordance with claim 1 further comprising a casing containing said transducer, said coupling circuit and all of said means and shaped and dimensioned to be held in a user's hand.

* * * * *

US005805164A

United States Patent [19]

Blum et al.

[11] Patent Number: 5,805,164

[45] Date of Patent: *Sep. 8, 1998

[54] **DATA DISPLAY AND ENTRY USING A LIMITED-AREA DISPLAY PANEL**

[75] Inventors: **Jeffrey R. Blum; Sarah E. Zuberec**, both of Seattle, Wash.

[73] Assignee: **Microsoft Corporation**, Redmond, Wash.

[*] Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

[21] Appl. No.: **639,636**

[22] Filed: **Apr. 29, 1996**

[51] **Int. Cl.**[6] **C06F 3/14**

[52] **U.S. Cl.** **345/347**; 345/340

[58] **Field of Search** 395/347, 340, 395/339, 326, 352, 353, 346, 800.01; 345/347, 326, 354, 328, 327, 339, 340, 341, 357, 342, 343, 344, 352, 353, 345, 346

[56] **References Cited**

U.S. PATENT DOCUMENTS

5,247,611	9/1993	Norden-Paul et al.	395/340
5,546,521	8/1996	Martinez	395/340
5,563,997	10/1996	Fisher	395/347
5,568,451	10/1996	Fukutomi	368/10
5,602,997	2/1997	Carpenter et al.	395/349
5,606,712	2/1997	Hidaka	395/800
5,640,577	6/1997	Scharmer	395/768

OTHER PUBLICATIONS

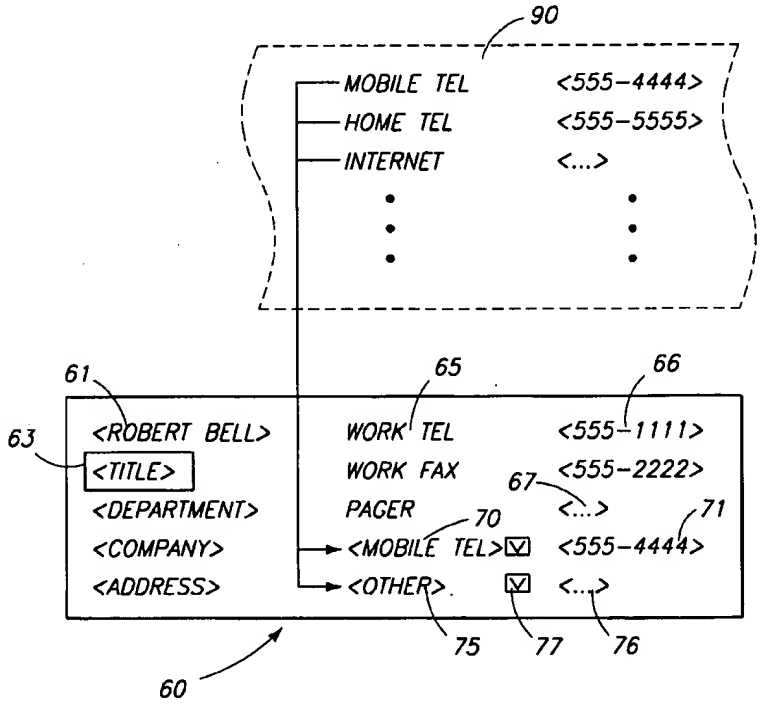
Cary N. Prague and Michael R. Irwin, *Access For Windows 95 Bible, Third Edition,* (IDG Books Worldwide, Inc., 1995), pp. 471–475.

Primary Examiner—Raymond J. Bayerl
Assistant Examiner—Steve Sax
Attorney, Agent, or Firm—Lee & Hayes, PLLC

[57] **ABSTRACT**

A user interface utilizes a variable or changeable displayed field label and an associated data entry field for displaying and entering stored database properties. A pop-up list box is associated with the displayed field label, to be selectively displayed in response to a user's selection. When displayed, the pop-up list box contains a list of available field labels that can be alternatively selected by the user as the displayed field label. Each of the field labels corresponds to a different stored property. The data entry field corresponding to the displayed field label can be selected and used to enter a value for the stored property corresponding to the displayed field label. The pop-up list box contains an indication of any existing values for the stored properties corresponding to the available field labels. This indication clarifies to the user that the available field labels correspond respectively to different stored properties, rather than being alternative labels corresponding to a single stored property.

12 Claims, 4 Drawing Sheets



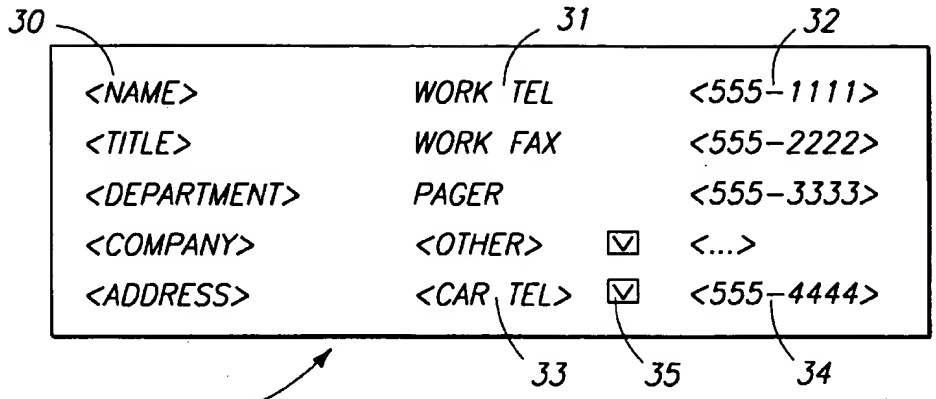


Fig 1 Prior Art

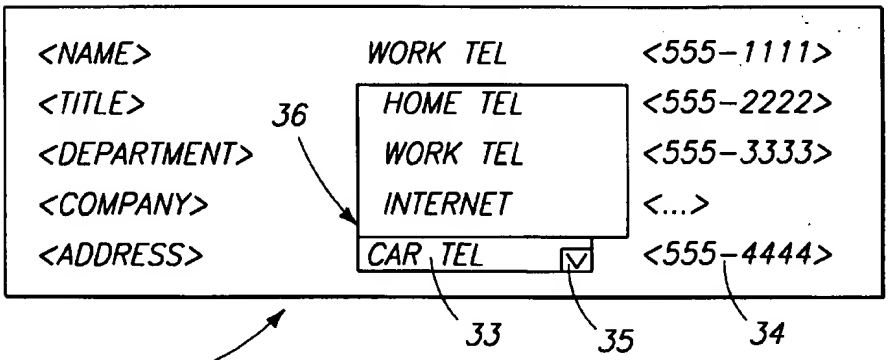


Fig 2 Prior Art

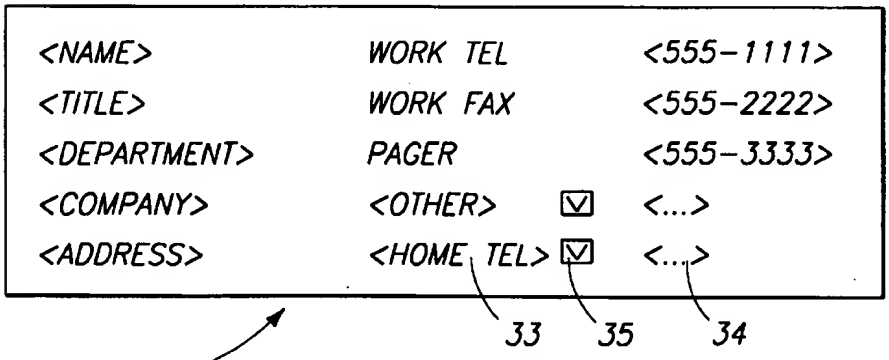


Fig 3 Prior Art

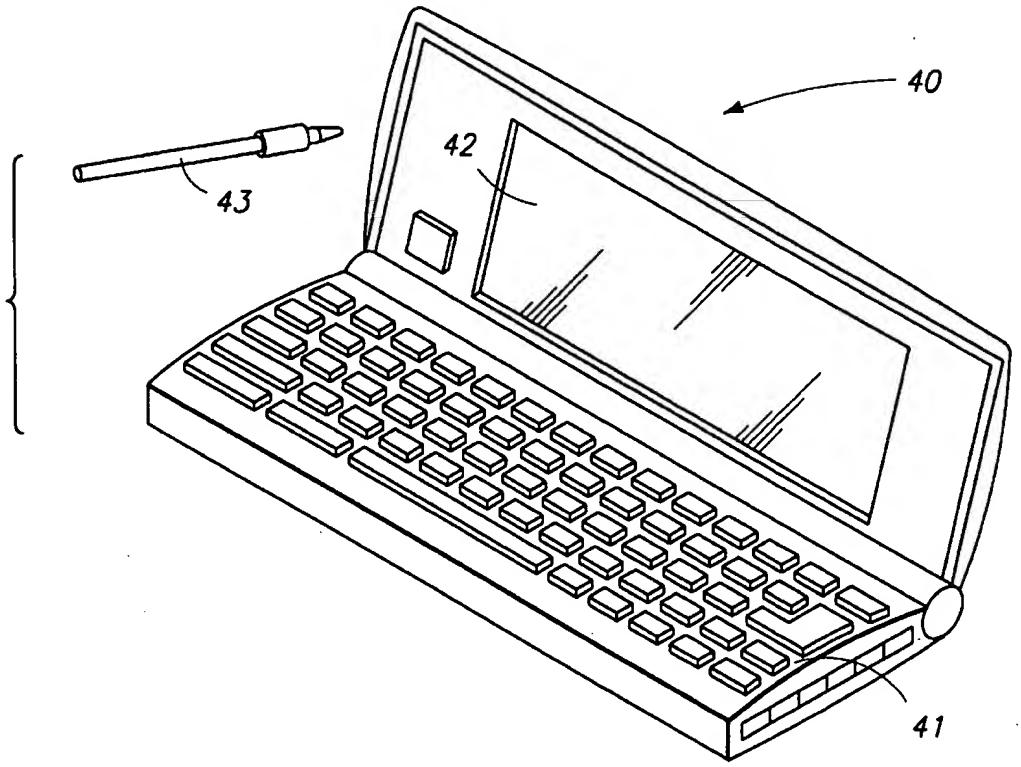


Fig 4

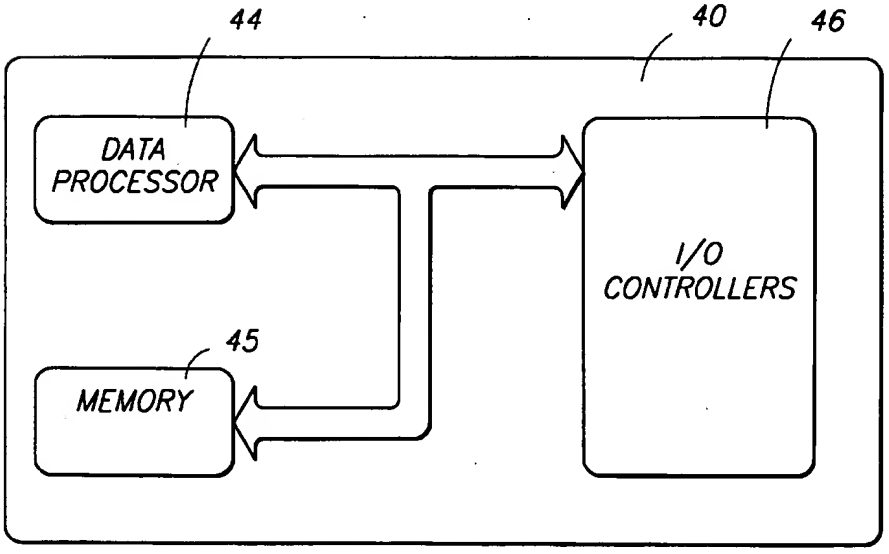


Fig 5

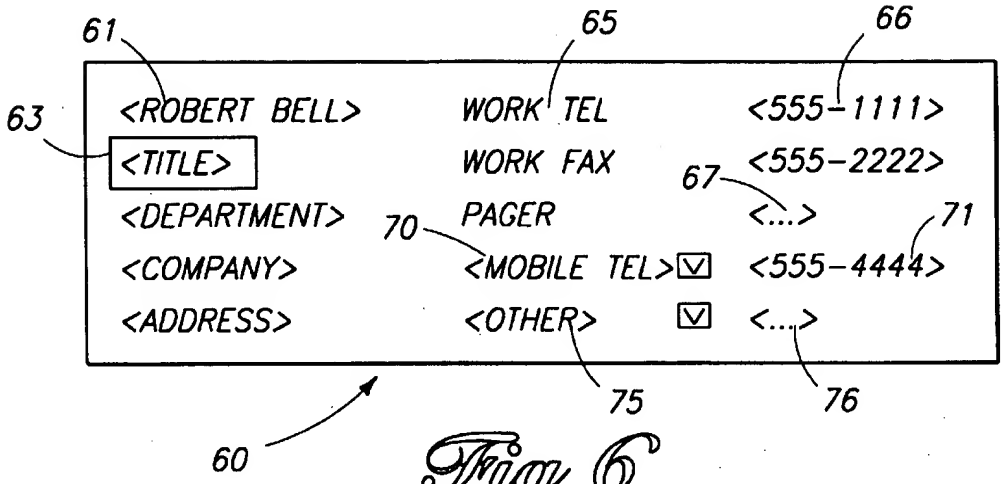

61
65
66
63
<ROBERT BELL>
WORK TEL
<555-1111>
<TITLE>
WORK FAX
<555-2222>
67
<DEPARTMENT>
PAGER
<...>
71
70
<COMPANY>
<MOBILE TEL>
<555-4444>
<ADDRESS>
<OTHER>
<...>
75
76
60

Fig 6

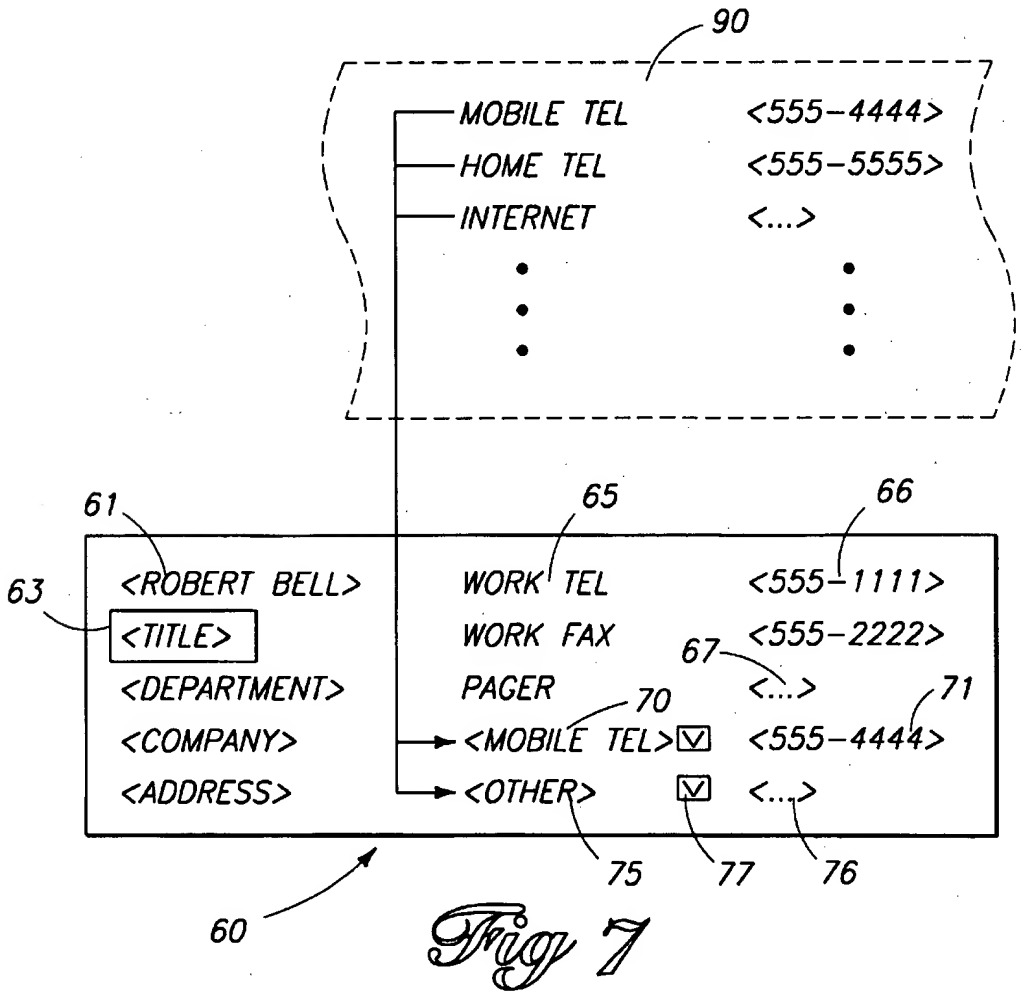

90
MOBILE TEL
<555-4444>
HOME TEL
<555-5555>
INTERNET
<...>
61
65
66
63
<ROBERT BELL>
WORK TEL
<555-1111>
<TITLE>
WORK FAX
<555-2222>
67
<DEPARTMENT>
PAGER
<...>
71
70
<COMPANY>
<MOBILE TEL>
<555-4444>
<ADDRESS>
<OTHER>
<...>
75
77
76
60

Fig 7

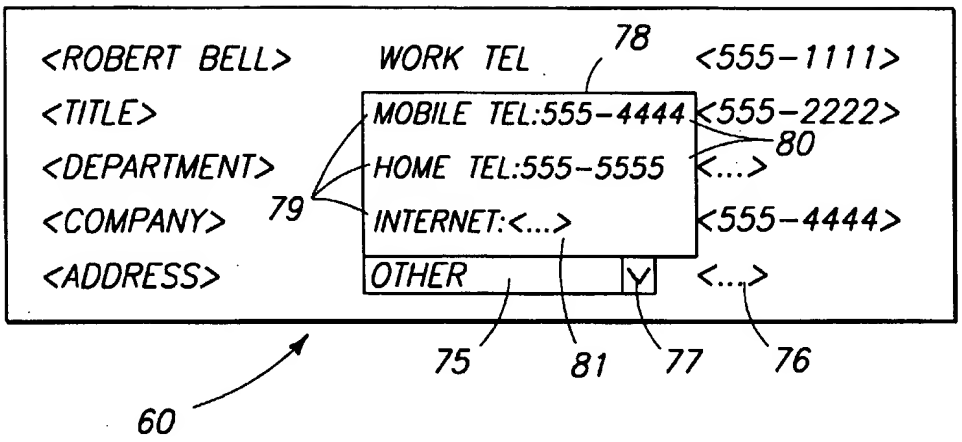

<ROBERT BELL>
<TITLE>
<DEPARTMENT>
<COMPANY>
<ADDRESS>
WORK TEL
MOBILE TEL:555-4444
HOME TEL:555-5555
INTERNET:<...>
OTHER
<555-1111>
<555-2222>
<...>
<555-4444>
<...>
78
79
80
75
81
77
76
60

Fig 8

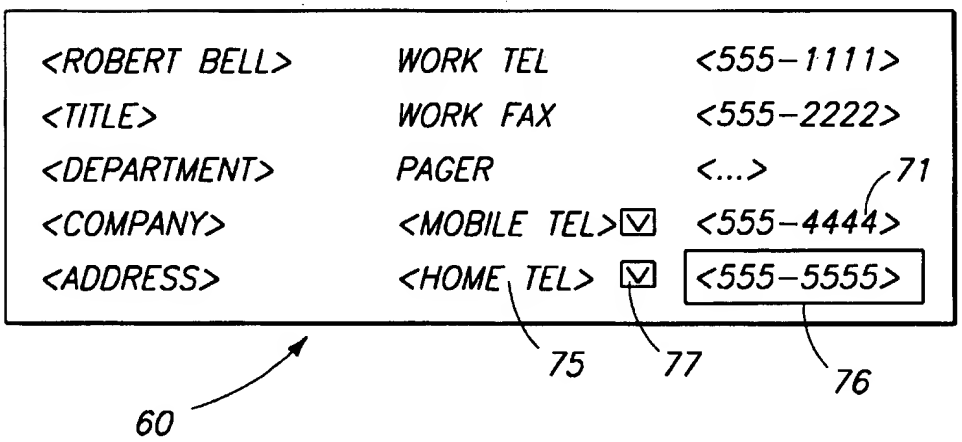

<ROBERT BELL>
<TITLE>
<DEPARTMENT>
<COMPANY>
<ADDRESS>
WORK TEL
WORK FAX
PAGER
<MOBILE TEL>
<HOME TEL>
<555-1111>
<555-2222>
<...>
<555-4444>
<555-5555>
71
75
77
76
60

Fig 9

DATA DISPLAY AND ENTRY USING A LIMITED-AREA DISPLAY PANEL

TECHNICAL FIELD

This invention relates to user interfaces for portable or handheld computing devices having limited display areas.

BACKGROUND OF THE INVENTION

Hand-held electronic organizers or PDAs (personal digital assistants) are becoming popular as replacements for paper-based organizers and appointment books. These devices are designed to be pocketable and easily accessible so that users feel comfortable taking them anywhere. They typically have miniature QWERTY keyboards and small user displays.

Most electronic organizers include a variety of application programs such as address book, calendar, and task management application programs. While the computing capabilities of typical organizers are sufficient to implement fairly complex application programs, the small display screens present challenges and problems in designing convenient and effective user interfaces.

FIG. **1** shows a portion of a user interface **29** that might be implemented by an address book program. Such a program typically maintains a plurality of records, corresponding respectively to different persons or businesses. Each record comprises a plurality of individual properties, such as first, middle, and last names, telephone numbers, address components, etc.

The user interface of FIG. **1** includes three different types of field labels. Each field label is associated with a data entry field. The field label referenced by numeral **30** is of a type that initially occupies its associated data entry field. This type of field label is referred to herein as a "temporary" field label. The user can select the temporary field label and overwrite it with data. After data entry, the field label is no longer displayed. This type of field label is appropriate when a field type can be fairly easily identified by its data or by the location of the field in relation to other fields.

The type of field label referenced by numeral **31** is positioned adjacent an associated data entry field **32** both before and after data is entered into the data entry field. This type of label, referred to herein as a "permanent" field label, is appropriate when data must be identified at all times by a label for the data to be meaningful.

The field label referenced by numeral **33** is referred to herein as a "variable" field label. It can be changed by a user. It is associated with a data entry field **34**. Like permanent field label **31**, variable field label **33** remains visible both before and after data entry. However, a control **35** is positioned adjacent the field label to allow a user to change it. Selecting the control or any part of the field label (for instance by touching it with stylus **43**) activates or opens a pop-up list box **36** as shown in FIG. **2**, containing a listing or menu of possible or available field labels. Pop-up boxes or controls such as these can be easily implemented in graphical operating system environments, where they are also referred to as combo boxes or drop-down boxes. The user can select one of the available field labels, whereupon the pop-up list box closes, as shown in FIG. **3**, and the selected field label is displayed in the original location referenced by numeral **33**. The field label actually selected and displayed on the user display is referred to herein as the "displayed" field label.

A variable field label can be used when there is a limited display area. It is possible to use a single data entry field, associated with a variable field label, for displaying and entering data relating to a plurality of individual properties. The user can select which property occupies such a data entry field at any particular time by selecting from the available field labels in the pop-up list associated with the variable field label.

Unfortunately, user tests have shown that such a data display and entry scheme sometimes confuses users. This is because users often think that changing a variable field label will change only the label applied to a particular property—rather than the property associated with the data entry field. In the sequence of FIGS. **1**, **2**, and **3**, for instance, field label **33** initially reads "Car Tel," indicating that the corresponding data entry field **34** represents someone's car telephone number. When a user changes the field label to "Home Tel," the data previously entered for the "Car Tel" disappears from data entry field **34** because that data entry field is no longer used to represent the "Car Tel" property. Rather, it is now used to represent the "Home Tel" property, which initially contains no data. Although the data for "Car Tel" is still being stored, the user often does not understand this, and might believe that the previously entered data has been lost. Simply stated, the user often expects that the data in data entry field **34** will remain the same regardless of the field label chosen.

This can seriously undermine the confidence of users. To meet the needs of the widest ranges of consumers, a user interface in a PDA should avoid any source of possible confusion while still allowing efficient and intuitive data display and entry.

The invention described below reduces or eliminates the potential confusion resulting from the variable labeling scheme described above. This is accomplished without distracting display elements. The invention results in a user interface with greater clarity and usefulness than variable data field labeling schemes used in the prior art.

SUMMARY OF THE INVENTION

The invention allows a single data entry field to be used to display and accept data entry for a selected one of a plurality of properties. The data entry field is associated with a variable field label. The variable field label is associated with a pop-up list box containing a list of available field labels from which the user can select. In addition, each of the available field labels is followed by any existing data that has been entered for the corresponding property. This clarifies to the user that data is being stored for each of the field labels shown in the pop-up list box.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. **1–3** illustrate the operation of a prior art data display and entry interface.

FIG. **4** shows a portable data entry device or electronic organizer accordance with the invention.

FIG. **5** is a simplified block diagram of the electronic organizer of FIG. **4**.

FIGS. **6–9** show the operation of a data display and entry interface as implemented in accordance with the invention on the electronic organizer of FIG. **4**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. **4** shows a hand-held electronic organizer, PDA (personal digital assistant), or other portable data entry device, generally designated by reference numeral **40**. Orga-

nizer **40** has a miniature QWERTY keyboard **41** and a user display **42** comprising a small LCD screen or panel. The screen is preferably a touch-sensitive screen for use with a stylus **43**. It has a preferred minimum resolution of 480×240 pixels. In the preferred embodiment, the user display is a bit-mapped or pixel-addressable display, allowing the display of both text and graphics.

As shown in the block diagram of FIG. **5**, organizer **40** has a data processor **44**, memory **45**, and I/O controllers **46** that are operatively connected to interact with the various hardware elements of the PDA such as keyboard **41**. LCD screen **42** is also responsive to data processor **44** through I/O controllers **46**. Memory **45** includes battery-backed, randomly-addressable, read/write memory (RAM) for data storage, and read-only memory (ROM) containing an operating system and pre-installed application programs.

PDA **40** includes in its standard configuration a variety of application programs designed for execution by data processor **44**. For instance, PDA **40** has address book, calendar, and task management application programs. These application programs operate under a graphical operating system similar to the Windows 95® operating system, produced by Microsoft Corporation of Redmond, Wash. The application programs use the graphical user interface features of the operating system to provide a familiar environment for users that might already be familiar with the Windows 95® operating system in a desktop environment.

The invention is described below in conjunction with an address book program running from memory **45** on data processor **44**, although the invention is also useful in other data display and entry contexts where display areas are limited.

The read/write memory of electronic organizer **40** is accessible by data processor **44** for storing and retrieving data records such as an address book application program might maintain for different persons. Each record includes a plurality of individual stored properties. For instance, an address book record might include name, address, and telephone number properties. Each record potentially has more properties than can be meaningfully displayed simultaneously on LCD screen **42**. In other words, the LCD screen has a display area that is too small to simultaneously display all the individual properties of a data record in a way that is easily understandable by a user.

FIG. **6** shows a portion of preferred user interface **60** that might be used for data display and entry in an address book program on a device such as electronic organizer **40** that has a limited display area. User interface **60** comprises three different types of fields labels as discussed above in the Background section of this disclosure. The first type of field label, referred to herein as a "temporary" field label, is indicated by reference numeral **61**. This type of field label initially occupies the same display area that forms the data entry field corresponding to the field label. When data is entered in the data entry field, the field label is removed. For instance, the data entry field designated in FIG. **6** by reference numeral **61** initially contained a field label reading "Name". Once actual data (in this case the name "Robert Bell") was entered into the data entry field, however, the field label disappeared and was replaced by the data. The field name would reappear if the data were to be subsequently deleted from the data entry field for the particular record being displayed.

To enter data corresponding to a temporary field label, the field label is first selected by a user. The user selects a field label by touching it with a stylus, clicking on it with a mouse, or by moving a cursor to it with keyboard controls. The field label indicated by reference numeral **63** has been selected by a user. When selected, the entire field label is highlighted (indicated by a box for purposes of illustration). In contrast to prior art user interfaces of this nature, the entire field name remains visible until the user actually begins data entry. When the user presses the first data entry key, the entire field label disappears and is replaced by whatever data is being entered.

An example of a second type of field label, referred to herein as a "permanent" field label, is indicated in FIG. **6** by reference numeral **65**. A permanent field label is permanently displayed and is permanently associated with a separate data entry field. Field label **65** is associated with an adjacent data entry field **66**. To enter data corresponding to a particular field label, the user selects the adjacent data entry field and simply begins entering data. The data entry field initially contains some sort of indication that it is empty, such as the ellipsis referenced by numeral **67** of FIG. **6**. The ellipsis is deleted from the data entry field when data is entered into the field.

Two examples of the third type of field label are referenced by numerals **70** and **75** in FIG. **6**. This type of field label is referred to herein as a "variable" field label. It is very similar to a permanent field label, in that it is associated with an adjacent data entry field, in this case with data entry fields **71** and **76**, respectively. The data entry field is selectable by the user to enter a value for the stored data field or property corresponding to the variable field label. A field label such as field label **70** is not replaced by entered data. The data is entered on a separate data entry field.

A variable field label differs from a permanent field label in that it can be changed by the user. In FIG. **6**, field label **70** has been set to read "Mobile Tel". Corresponding data has been entered in associated data entry field **71**. The user, however, can change field label **70** to text that corresponds to a different record property. This is illustrated in FIG. **7**, which symbolically shows a portion of a database record **90**. The database record contains a plurality of fields, each referenced by a field label shown in the first column of the record. Each field also potentially contains data, shown in the second column of the record. The first field, for example, has a field label "Mobile Tel" and corresponding data "555-4444". Fields which do not yet contain data, such as the "Internet" field, are indicated by an ellipsis in the second column.

The portion of database record **90** is not displayed as illustrated in FIG. **7** to the user. Rather, a user is able to select any of these field labels as one of variable field labels **70** or **75**. When a particular field label is chosen, the associated data appears in data entry field **71** or **76**.

The process of selecting one of the field labels for variable field label **75** is shown in FIGS. **8–9**. Label **75** initially reads "Other"(FIG. **6**), indicating that the user has not yet made a selection for this label. No actual data is displayed or allowed to be entered in data entry field **76** when "Other" is the displayed field label.

As illustrated in FIG. **8**, a pop-up list is associated with displayed field label **75**. The pop-up list is selectively displayed in response to a user's selection. In the preferred embodiment, user interface **60** includes a control **77** associated with field label **75**. The pop-up list is displayed or activated when the user selects control **77**.

FIG. **8** shows user interface **60** after a pop-up list box **78**, associated with field label **75**, has been activated. Pop-up list box **78** contains a plurality of available field labels **79**,

corresponding to the fields of database record **90** of FIG. **7**, that can be alternatively selected by the user. When an available field label is selected, it becomes the displayed field label **75**. Each available field label **79** corresponds to a different stored record property or data field, as explained with reference to FIG. **7**. When a particular field label is selected to be the displayed field label, data entry field **76** displays data for the corresponding property, and allows data to be entered or modified for the corresponding property. When the displayed variable field label **75** is subsequently changed by the user, data entry field **76** displays and allows editing of data for a different property, corresponding to the newly selected field label.

In addition to a listing of available field labels, pop-up list box **78** contains an indication of any existing values for the stored properties corresponding to the available field labels. More specifically, each available field label is followed by a textual representation **80** of any data that has already been entered for the corresponding property. For instance, the available field label "Home Tel" is followed by the actual data already contained in the "Home Tel" record property (555-5555). In the preferred embodiment, the available field labels are positioned within the pop-up list box adjacent their corresponding values. For those properties for which values have not been entered, the pop-up list box includes an empty indicator, as referenced by numeral **81** in FIG. **7**, indicating that a value has not yet been entered.

FIG. **9** shows user interface **80** after "Home Tel" has been selected as the displayed field label. The user selects this label from list box **78** by touching it with the stylus or by using the keyboard. After the selection, data entry field **72** contains the data corresponding to the displayed field label, in this case the field labeled "Home Tel".

At any time, the user can re-activate the pop-up list box to again change variable field label **75**. The same selections are available to the user, and the user can see the data previously entered for any of the available database fields or properties.

While the invention has thus far been described primarily in terms of structural or graphical features associated with a user display, the invention also includes methodological steps that are preferably performed by the data processor or other logic components of a portable data entry device. These steps include placing or displaying a displayed field label on a user display, and placing or displaying a data entry field on the user display in proximity to the displayed field label. The data entry field contains an indication of any existing value for a stored property corresponding to the displayed field label. The invention further includes a step of associating a pop-up list box with the displayed field label, containing a plurality of available field labels. The available field labels correspond respectively to different stored properties.

Further steps in accordance with the invention include selectively displaying the pop-up list box on the user display in response to a user's selection, and selecting one of the available field labels in the pop-up list box as the displayed field label in response to user input. The invention also includes a step of including in the pop-up list box an indication of any existing values for the stored properties corresponding to the available field labels. Such an indication clarifies to the user that the available field labels correspond respectively to different stored properties. Empty indicators are included in the pop-up list box, associated with any available field label having a corresponding stored property for which a value has not been entered.

Indicating the data, within the pop-up list box, for properties for which data has already been entered clarifies to users that the available field labels correspond respectively to different stored properties rather than just being alternative labels for the same property. It has been found that this scheme greatly reduces or even eliminates user confusion regarding this issue.

In compliance with the statute, the invention has been described in language more or less specific as to structural and methodological features. It is to be understood, however, that the invention is not limited to the specific features and steps described, since the means herein disclosed comprise preferred forms of putting the invention into effect. The invention is, therefore, claimed in any of its forms or modifications within the proper scope of the appended claims appropriately interpreted in accordance with the doctrine of equivalents.

We claim:

1. A portable user interface comprising:

a user display having a display area that is too small to simultaneously display all of the individual properties of a data record in a way that is easily understandable by a user;

a plurality of displayed field labels on the user display;

a pop-up list box associated with a particular one of the displayed field labels, the pop-up list box being selectively overlaid on the displayed field labels in response to a user's selection;

the pop-up list box containing a plurality of available field labels that can be alternatively selected by the user as the displayed field label, wherein the field labels correspond respectively to different stored properties;

a data entry field corresponding to said particular one of the displayed field labels, the data entry field being displayed on the user display simultaneously with the plurality of displayed field labels, the data entry field being selectable by a user to enter a value for the stored property corresponding to the displayed field label;

the pop-up list box further containing an indication of any existing values for the stored properties corresponding to the available field labels, said indication clarifying to the user that the available field labels correspond respectively to different stored properties.

2. A user interface as recited in claim **1** wherein the pop-up list box includes an empty indicator associated with any available field label having a corresponding stored property for which a value has not been entered.

3. A user interface as recited in claim **1** wherein the respective available field labels are positioned within the pop-up list box adjacent the indications of existing values for the corresponding stored properties.

4. A portable data entry device, comprising:

a data processor;

data memory accessible by the data processor for storing data records, each data record including a plurality of individual stored properties;

a user display that is responsive to the data processor, the user display having a display area that is too small to simultaneously display all of the individual properties of a data record in a way that is easily understandable by a user;

the data processor being programmed to display individual stored properties of a data record by performing the following steps:

placing a displayed field label on the user display;

associating a pop-up list box with the displayed field label, the pop-up list box containing a plurality of available field labels, wherein the available field labels correspond respectively to different stored properties;

selectively overlaying the pop-up list box on the user display containing the displayed field label in response to a user's selection;

selecting one of the available field labels in the pop-up list box as the displayed field label in response to user input;

displaying a data entry field on the user display simultaneously with the displayed field label, the data entry field containing an indication of any existing value for the stored property corresponding to the displayed field label;

including in the pop-up list box an indication of any existing values for the stored properties corresponding to the available field labels, said indication clarifying to the user that the available field labels correspond respectively to different stored properties.

5. A portable data entry device as recited in claim **4** wherein the data processor is further programmed to perform a step of including in the pop-up list box an empty indicator associated with any available field label having a corresponding stored property for which a value has not been entered.

6. A portable data entry device as recited in claim **4** wherein the data processor is further programmed to perform a step of positioning the respective available field labels within the pop-up list box adjacent the indications of existing values for the corresponding stored properties.

7. A method of displaying stored data properties on a portable user interface, comprising the following steps:

placing a displayed field label on a user display, the user display having a display area that is too small to simultaneously display all of the individual properties of a data record in a way that is easily understandable by a user;

associating a pop-up list box with the displayed field label, the pop-up list box containing a plurality of available field labels, wherein the available field labels correspond respectively to different stored properties;

selectively overlaying the pop-up list box on the user display containing the displayed field label in response to a user's selection;

selecting one of the available field labels in the pop-up list box as the displayed field label in response to user input;

displaying a data entry field on the user display simultaneously with the plurality of displayed field labels in proximity to the displayed field label, the data entry field containing an indication of any existing value for the stored property corresponding to the displayed field label;

including in the pop-up list box an indication of any existing values for the stored properties corresponding to the available field labels, said indication clarifying to the user that the available field labels correspond respectively to different stored properties.

8. A method as recited in claim **7** and further comprising a step of including in the pop-up list box an empty indicator associated with any available field label having a corresponding stored property for which a value has not been entered.

9. A portable data entry device as recited in claim **7** and further comprising a step of positioning the respective available field labels within the pop-up list box adjacent the indications of existing values for the corresponding stored properties.

10. A computer-readable storage medium containing instructions that are executable by a computer to perform steps comprising:

placing a plurality of displayed field labels on a portable user display having a display area that is too small to simultaneously display all of the individual properties of a data record in a way that is easily understandable by a user;

associating a pop-up list box with a particular one of the displayed field labels, the pop-up list box containing a plurality of available field labels, wherein the available field labels correspond respectively to different stored properties;

selectively overlaying the pop-up list box on the user display containing the displayed field labels in response to a user's selection;

selecting one of the available field labels in the pop-up list box as the particular one of the displayed field labels in response to user input;

displaying the selected field label as the particular one of the displayed field labels;

displaying a data entry field on the user display simultaneously with the plurality of displayed field labels in proximity to the displayed field label, the data entry field containing an indication of any existing value for the stored property corresponding to the displayed field label;

including in the pop-up list box an indication of any existing values for the stored properties corresponding to the available field labels, said indication clarifying to the user that the available field labels correspond respectively to different stored properties.

11. A computer-readable storage medium as recited in claim **10**, the instructions being executable to perform a further step of including in the pop-up list box an empty indicator associated with any available field label having a corresponding stored property for which a value has not been entered.

12. A computer-readable storage medium as recited in claim **10**, the instructions being executable to perform a further step of positioning the respective available field labels within the pop-up list box adjacent the indications of existing values for the corresponding stored properties.

* * * * *

US006345273B1

(12) **United States Patent**
Cochran

(10) **Patent No.: US 6,345,273 B1**
(45) **Date of Patent: Feb. 5, 2002**

(54) **SEARCH SYSTEM HAVING USER-INTERFACE FOR SEARCHING ONLINE INFORMATION**

(76) Inventor: **Nancy P. Cochran**, 52 Gedney St., Nyack, NY (US) 10960

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/427,737**

(22) Filed: **Oct. 27, 1999**

(51) **Int. Cl.**[7] **G06F 17/30**
(52) **U.S. Cl.** **707/4**; 707/3; 707/6
(58) **Field of Search** 707/3, 5, 100, 707/104, 4, 6; 345/353, 348, 347, 352, 356; 705/2; 395/352

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,500,936	A *	3/1996	Allen et al.	345/348
5,781,904	A *	7/1998	Oren et al.	707/100
5,805,164	A *	9/1998	Blum et al.	345/347
5,805,167	A *	9/1998	Van Cruyningen	345/353
5,828,376	A *	10/1998	Solimene et al.	395/352
5,907,704	A *	5/1999	Gudmundson et al.	717/1
5,912,667	A *	6/1999	Chang	345/347
5,913,208	A *	6/1999	Brown et al.	707/3
5,915,240	A *	6/1999	Karpf	705/2
5,959,629	A *	9/1999	Masui	345/347
5,982,370	A *	11/1999	Kamper	345/356
6,012,055	A *	1/2000	Campbell et al.	707/5
6,038,560	A *	3/2000	Wical	707/5
6,070,158	A *	5/2000	Kirsch et al.	707/3

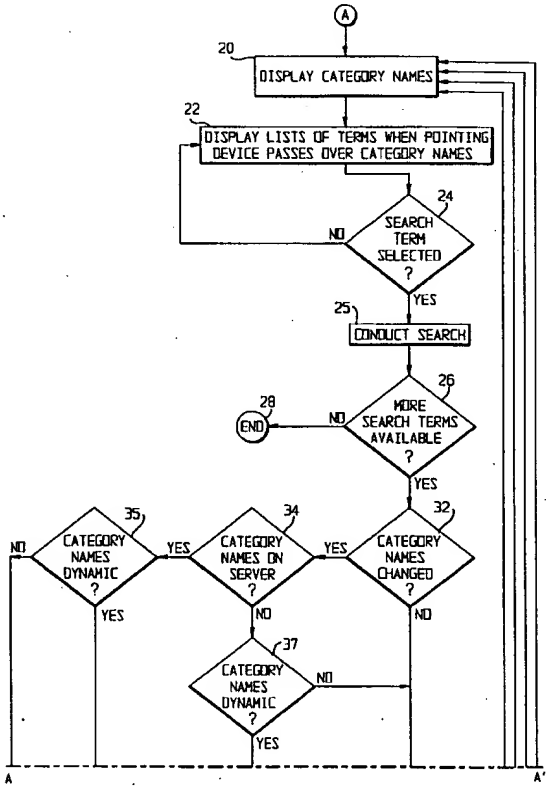
* cited by examiner

Primary Examiner—Thomas Black
Assistant Examiner—Thuy Pardo
(74) *Attorney, Agent, or Firm*—Blank Rome Comisky & McCauley LLP

(57) **ABSTRACT**

A system for facilitating the searching of data from an electronic data source. The invention teaches a method for presenting a large number of search terms rapidly and efficiently to a user. Users may scan a large number of search terms, move quickly from one search category to another, select a search term with minimal mechanical input and generate a series of "hits" that meet their search goals. The need to guide the computer with mechanical actions from a keyboard, mouse or other device is minimized. Graphics that distract the user from any task other than selecting hits are eliminated. Users are able to scan quickly and find electronic information with minimum effort.

32 Claims, 9 Drawing Sheets



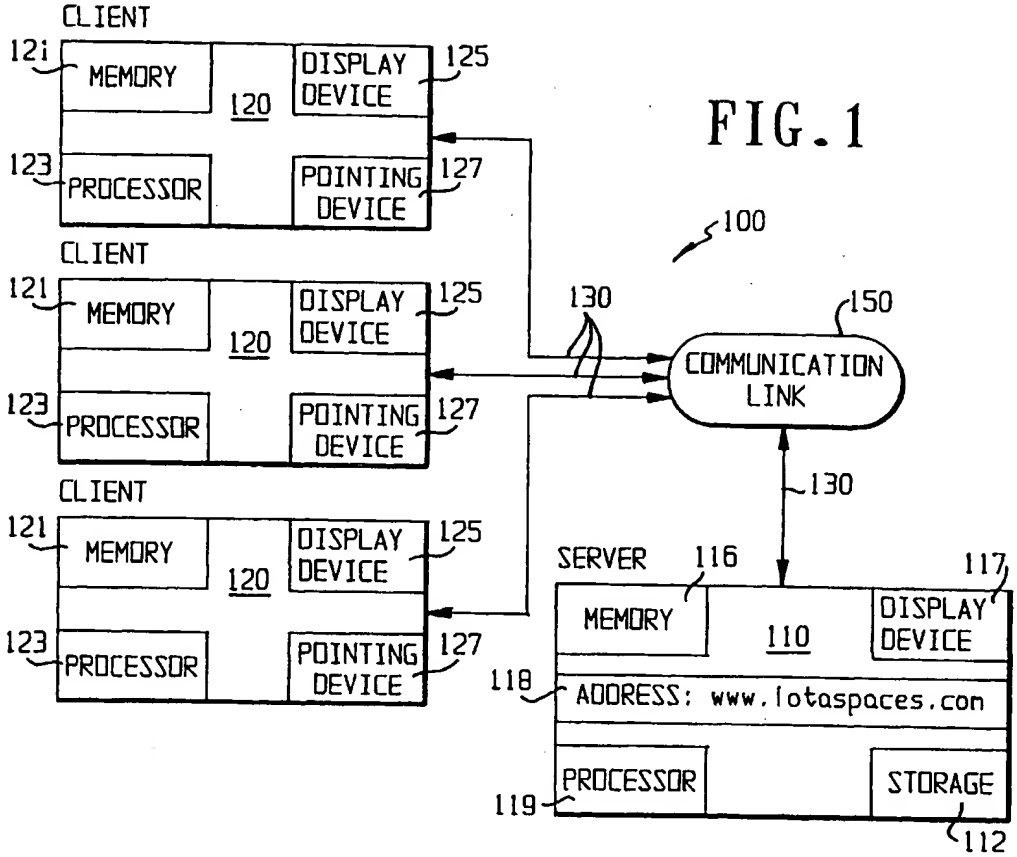
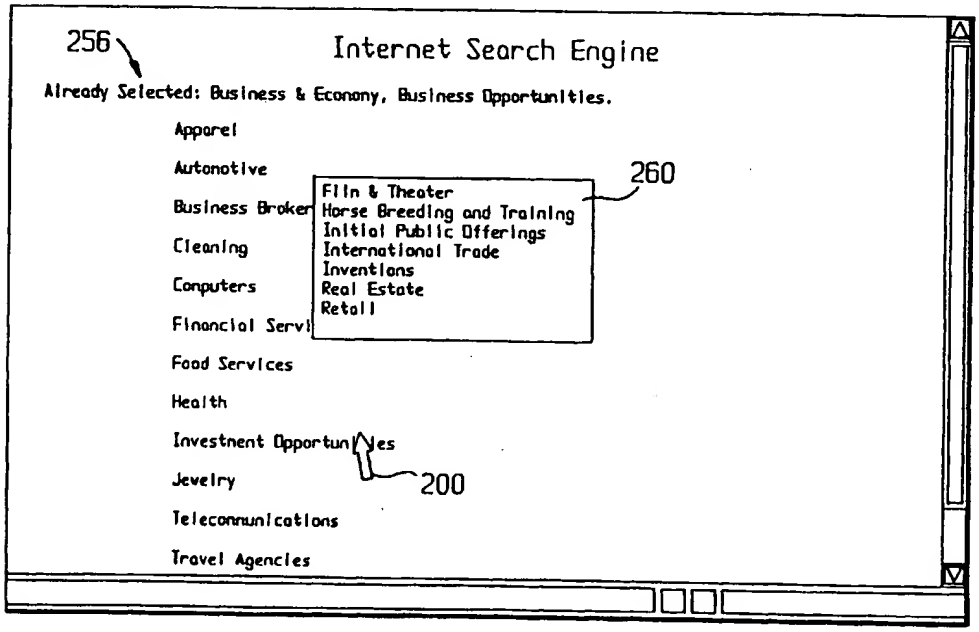

CLIENT
121
MEMORY
120
DISPLAY DEVICE
125
123
PROCESSOR
POINTING DEVICE
127
CLIENT
CLIENT
100
130
150
COMMUNICATION LINK
SERVER
116
117
MEMORY
110
DISPLAY DEVICE
118
ADDRESS: www.iotaspaces.com
PROCESSOR
119
STORAGE
112

FIG. 1

FIG. 13


256
Internet Search Engine
Already Selected: Business & Economy, Business Opportunities.
Apparel
Autonotive
Business Broker
Cleaning
Computers
Financial Servi
Food Services
Health
Investment Opportunities
Jewelry
Teleconnunications
Travel Agencies
260
Film & Theater
Horse Breeding and Training
Initial Public Offerings
International Trade
Inventions
Real Estate
Retail
200

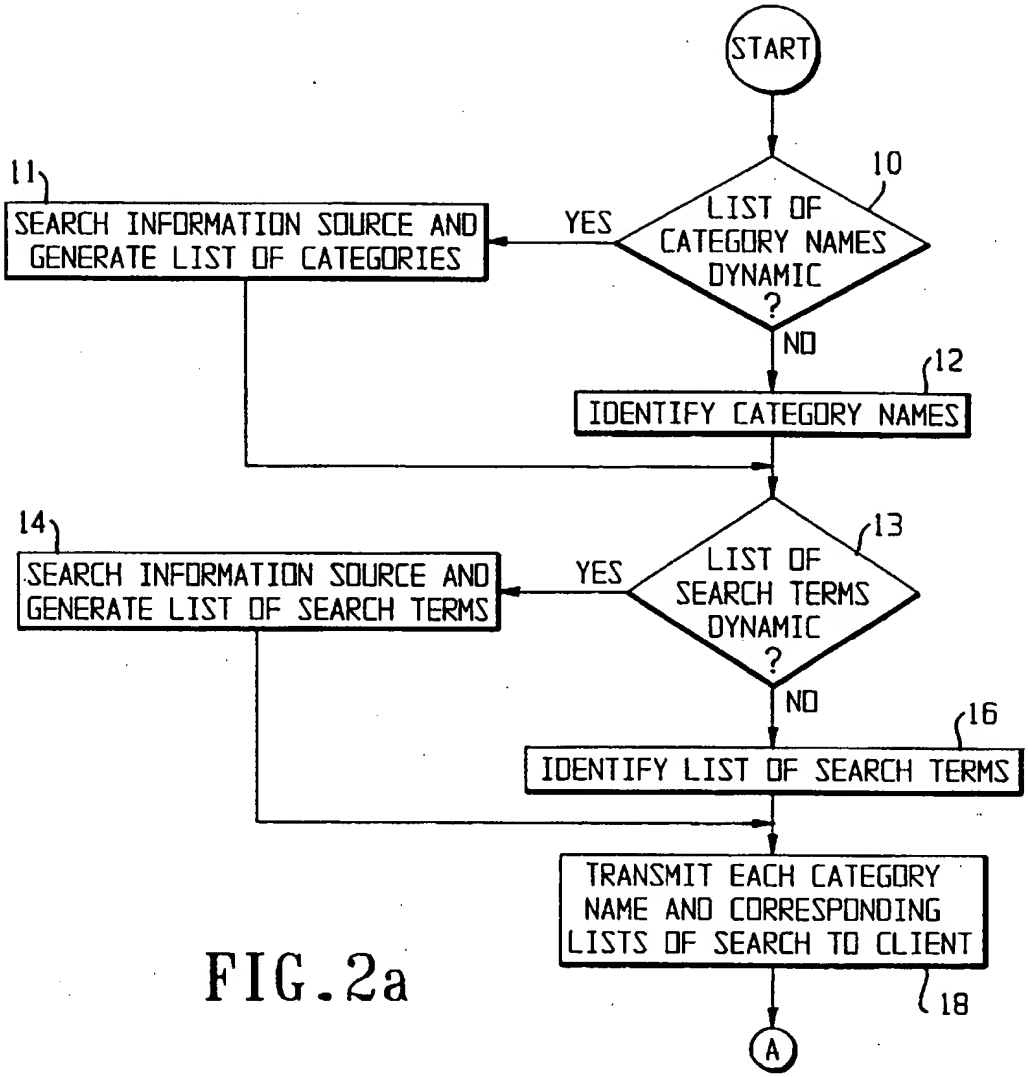

START
10
LIST OF CATEGORY NAMES DYNAMIC ?
YES
11
SEARCH INFORMATION SOURCE AND GENERATE LIST OF CATEGORIES
NO
12
IDENTIFY CATEGORY NAMES
13
LIST OF SEARCH TERMS DYNAMIC ?
YES
14
SEARCH INFORMATION SOURCE AND GENERATE LIST OF SEARCH TERMS
NO
16
IDENTIFY LIST OF SEARCH TERMS
TRANSMIT EACH CATEGORY NAME AND CORRESPONDING LISTS OF SEARCH TO CLIENT
18
A

FIG. 2a

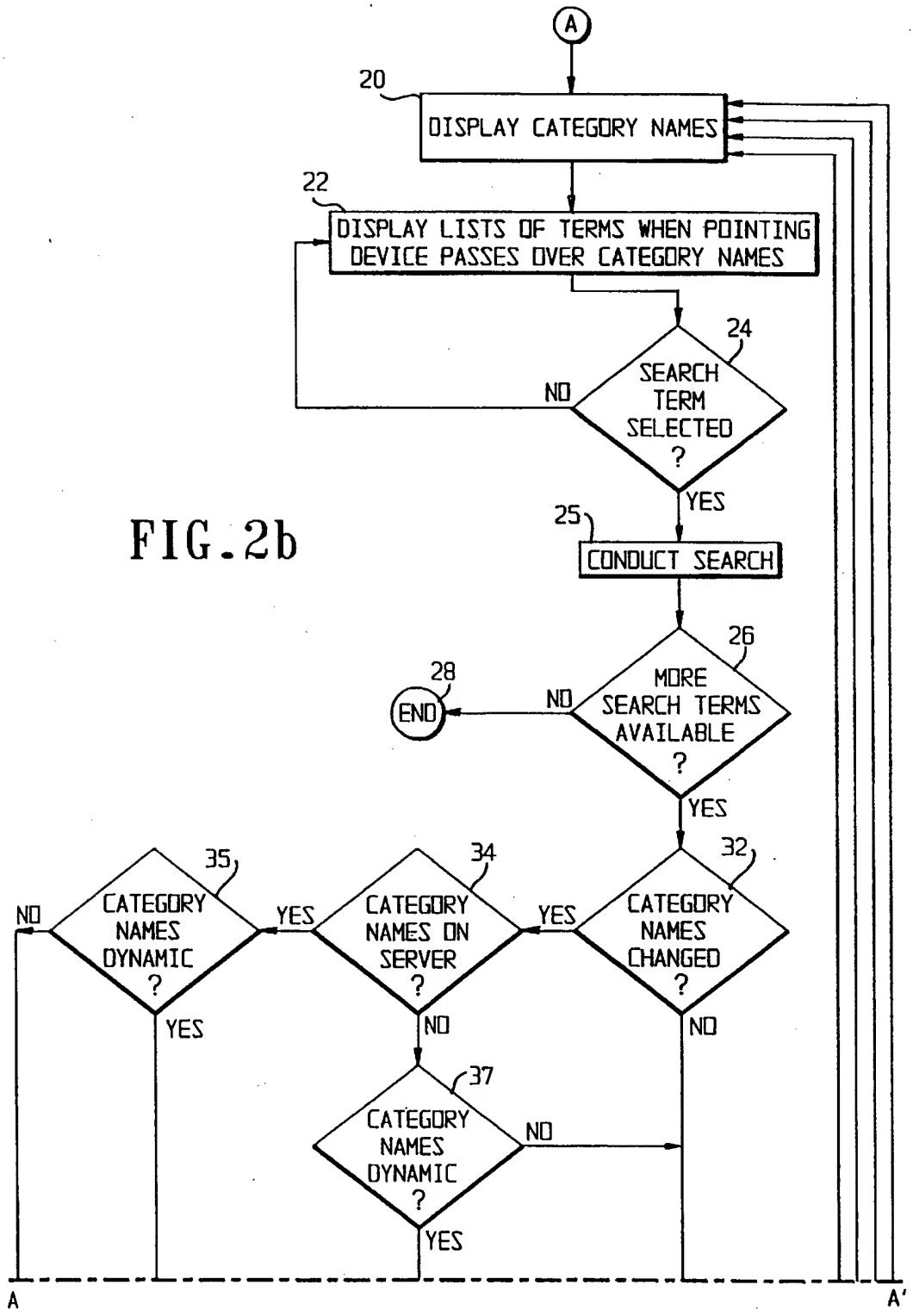

A
20
DISPLAY CATEGORY NAMES
22
DISPLAY LISTS OF TERMS WHEN POINTING DEVICE PASSES OVER CATEGORY NAMES
24
SEARCH TERM SELECTED ?
NO
YES
25
CONDUCT SEARCH
26
MORE SEARCH TERMS AVAILABLE ?
28
END
NO
YES
32
CATEGORY NAMES CHANGED ?
34
CATEGORY NAMES ON SERVER ?
35
CATEGORY NAMES DYNAMIC ?
37
CATEGORY NAMES DYNAMIC ?
A
A'

FIG. 2b

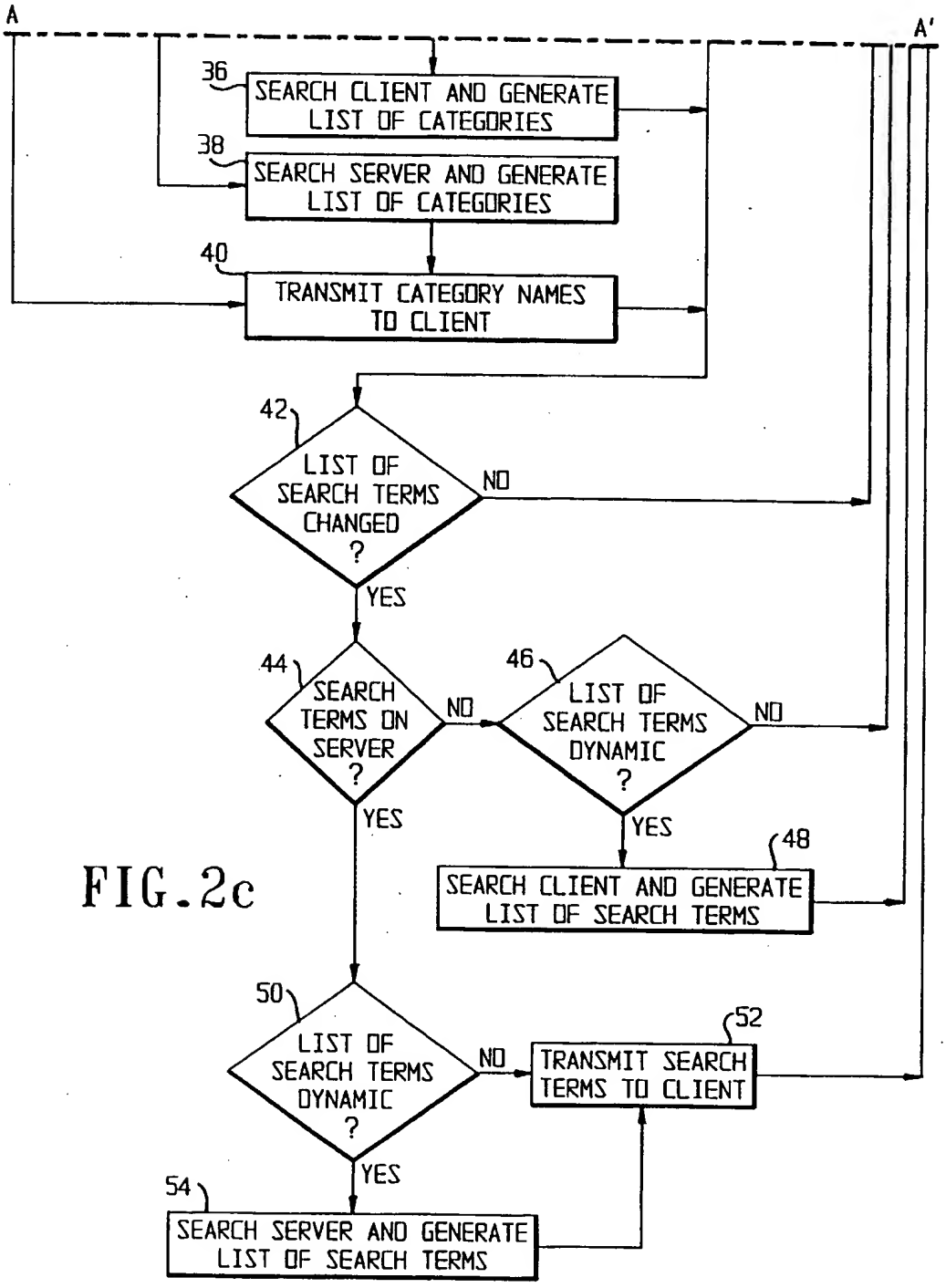

A
A'
36
SEARCH CLIENT AND GENERATE LIST OF CATEGORIES
38
SEARCH SERVER AND GENERATE LIST OF CATEGORIES
40
TRANSMIT CATEGORY NAMES TO CLIENT
42
LIST OF SEARCH TERMS CHANGED ?
NO
YES
44
SEARCH TERMS ON SERVER ?
NO
46
LIST OF SEARCH TERMS DYNAMIC ?
NO
YES
YES
48
SEARCH CLIENT AND GENERATE LIST OF SEARCH TERMS
50
LIST OF SEARCH TERMS DYNAMIC ?
NO
52
TRANSMIT SEARCH TERMS TO CLIENT
YES
54
SEARCH SERVER AND GENERATE LIST OF SEARCH TERMS

FIG. 2c

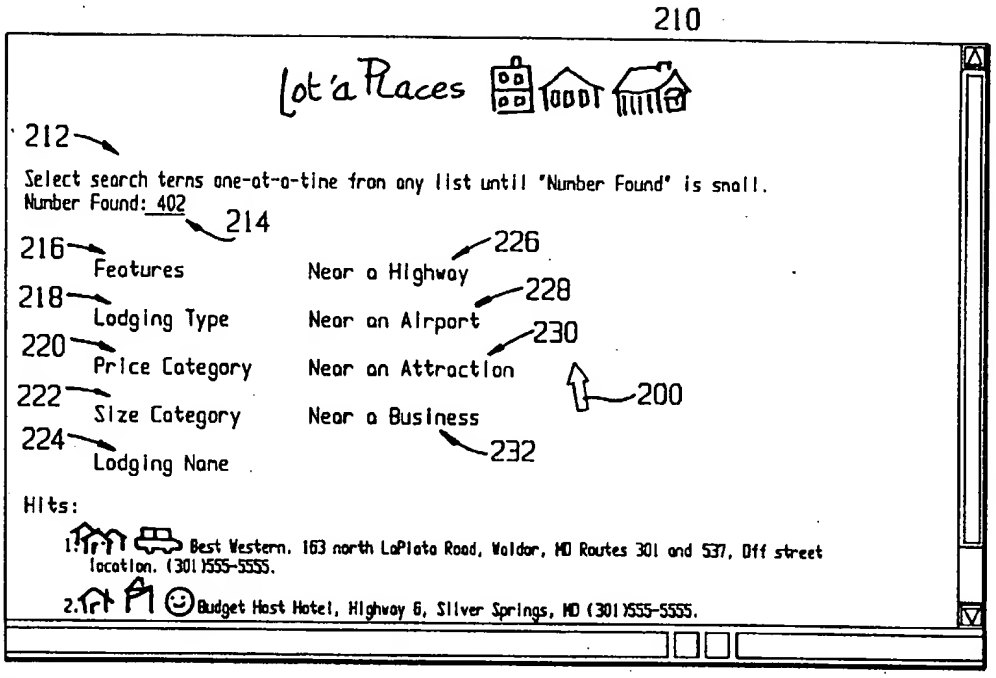

210
Lot'a Places
212
Select search terms one-at-a-time from any list until 'Number Found' is small.
Number Found: 402
214
216
Features
218
Lodging Type
220
Price Category
222
Size Category
224
Lodging Name
Near a Highway
226
Near an Airport
228
Near an Attraction
230
Near a Business
232
200
Hits:
1. Best Western. 163 north LaPlata Road, Waldor, MD Routes 301 and 537, Off street location. (301)555-5555.
2. Budget Host Hotel, Highway 6, Silver Springs, MD (301)555-5555.
234

FIG. 3

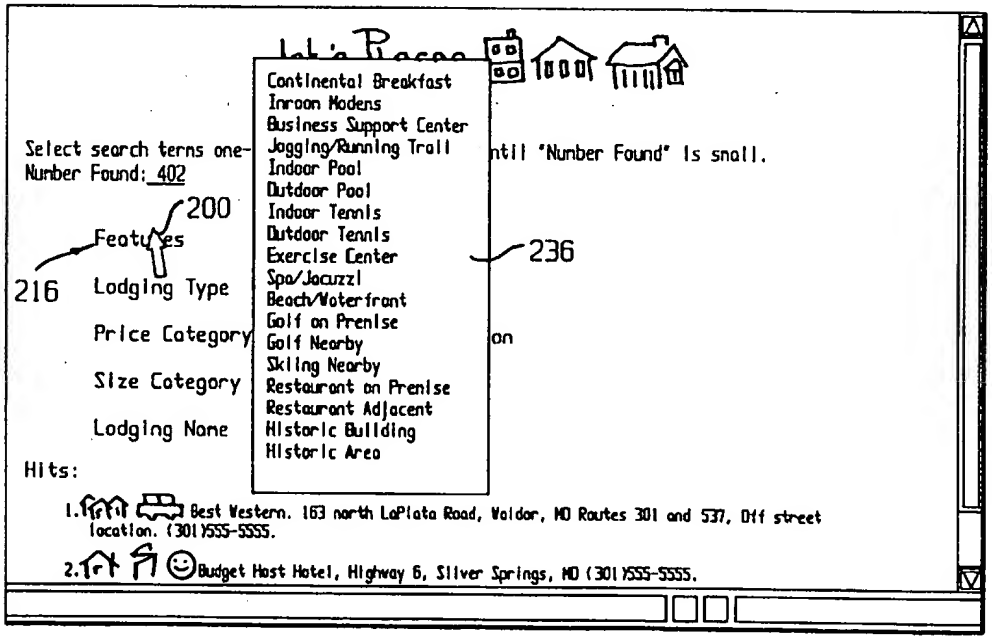

Continental Breakfast
Inroon Modens
Business Support Center
Jogging/Running Trail
Indoor Pool
Outdoor Pool
Indoor Tennis
Outdoor Tennis
Exercise Center
Spa/Jacuzzi
Beach/Waterfront
Golf on Prenise
Golf Nearby
Skiing Nearby
Restaurant on Prenise
Restaurant Adjacent
Historic Building
Historic Area
236
Select search terms one-
ntil 'Number Found' is small.
Number Found: 402
200
Features
216
Lodging Type
Price Category
Size Category
Lodging Name
on
Hits:
1. Best Western. 163 north LaPlata Road, Waldor, MD Routes 301 and 537, Off street location. (301)555-5555.
2. Budget Host Hotel, Highway 6, Silver Springs, MD (301)555-5555.

FIG. 4

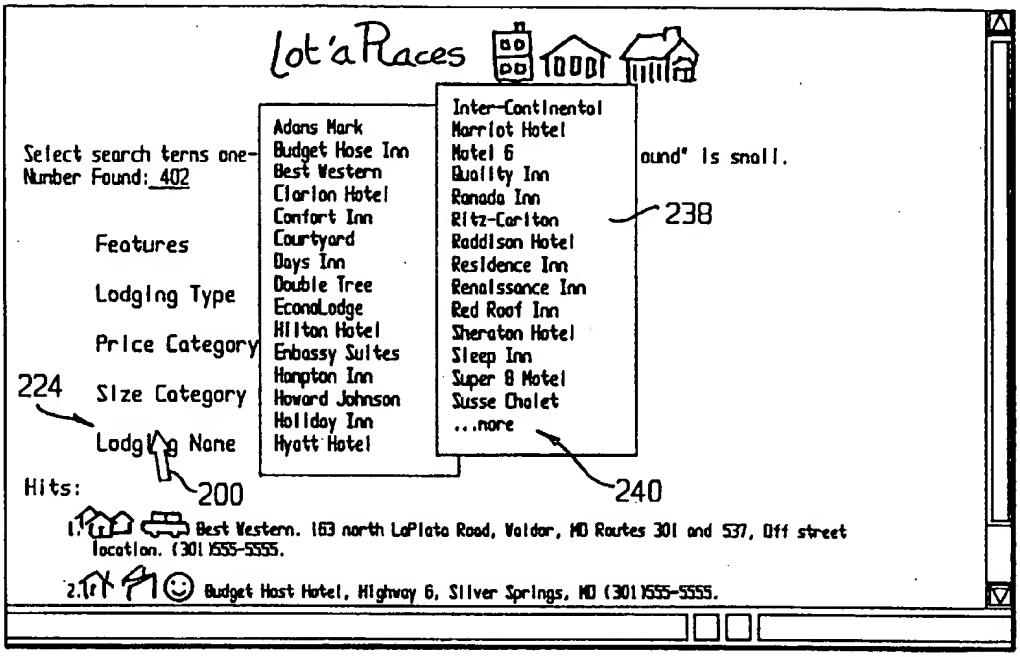

Lot'a Places
Select search terns one-
Number Found: 402
Features
Lodging Type
Price Category
Size Category
Lodging None
Hits:
Adams Mark
Budget Hose Inn
Best Western
Clarion Hotel
Confort Inn
Courtyard
Days Inn
Double Tree
EconoLodge
Hilton Hotel
Embassy Suites
Hampton Inn
Howard Johnson
Holiday Inn
Hyatt Hotel
Inter-Continental
Marriot Hotel
Motel 6
Quality Inn
Ramada Inn
Ritz-Carlton
Raddison Hotel
Residence Inn
Renaissance Inn
Red Roof Inn
Sheraton Hotel
Sleep Inn
Super 8 Motel
Susse Chalet
...more
ound" is small.
238
224
200
240
1. Best Western. 163 north LaPlata Road, Waldor, MD Routes 301 and 537, Off street location. (301)555-5555.
2. Budget Host Hotel, Highway 6, Silver Springs, MD (301)555-5555.

FIG. 5

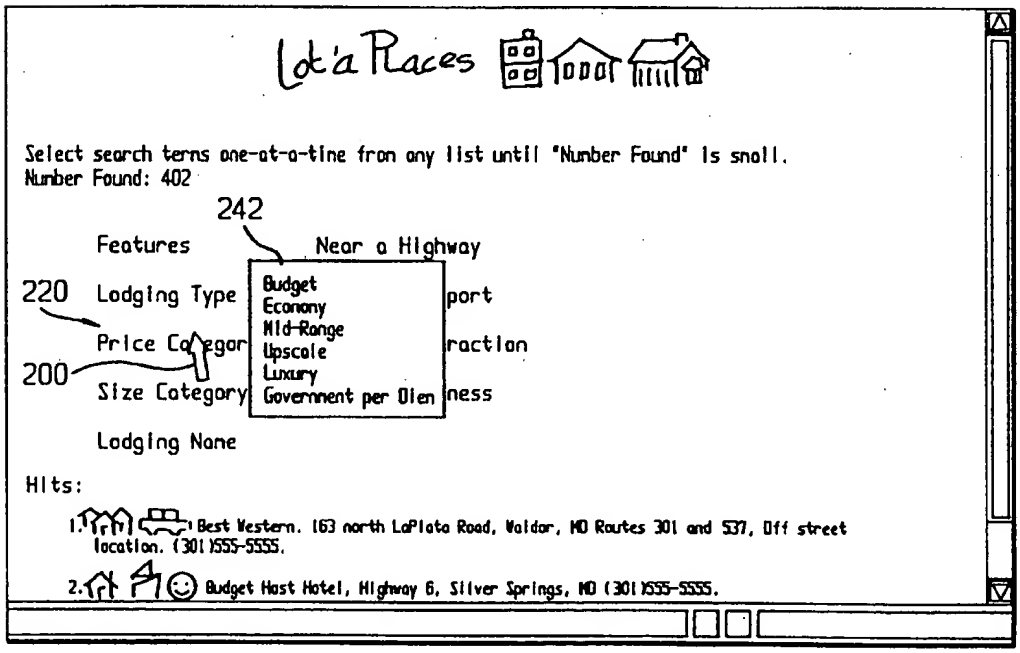

Lot'a Places
Select search terns one-at-a-time from any list until "Number Found" is small.
Number Found: 402
242
Features
Near a Highway
220
Lodging Type
Price Category
200
Size Category
Lodging None
Hits:
Budget
Economy
Mid-Range
Upscale
Luxury
Government per Dien
port
raction
ness
1. Best Western. 163 north LaPlata Road, Waldor, MD Routes 301 and 537, Off street location. (301)555-5555.
2. Budget Host Hotel, Highway 6, Silver Springs, MD (301)555-5555.

FIG. 6

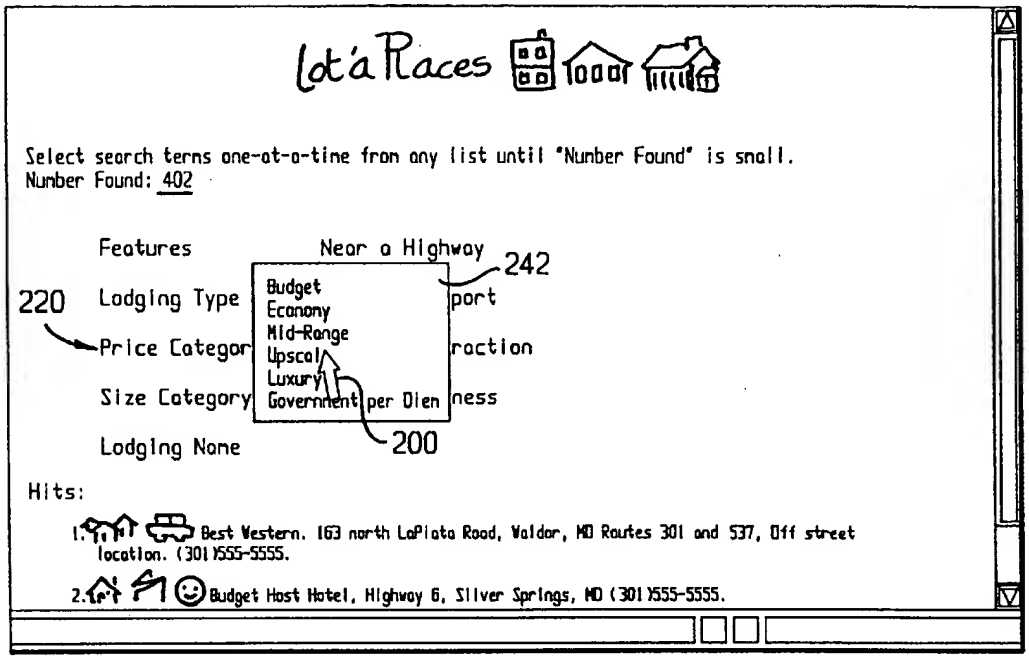

Lot'a Places
Select search terms one-at-a-time from any list until "Number Found" is small.
Number Found: 402
Features
Near a Highway
220
Lodging Type
Price Categor
Size Category
Lodging Name
Budget
Economy
Mid-Range
Upscal
Luxury
Government
per Dien
242
200
Hits:
1. Best Western. 163 north LaPlata Road, Waldor, MD Routes 301 and 537, Off street location. (301)555-5555.
2. Budget Host Hotel, Highway 6, Silver Springs, MD (301)555-5555.

FIG. 7

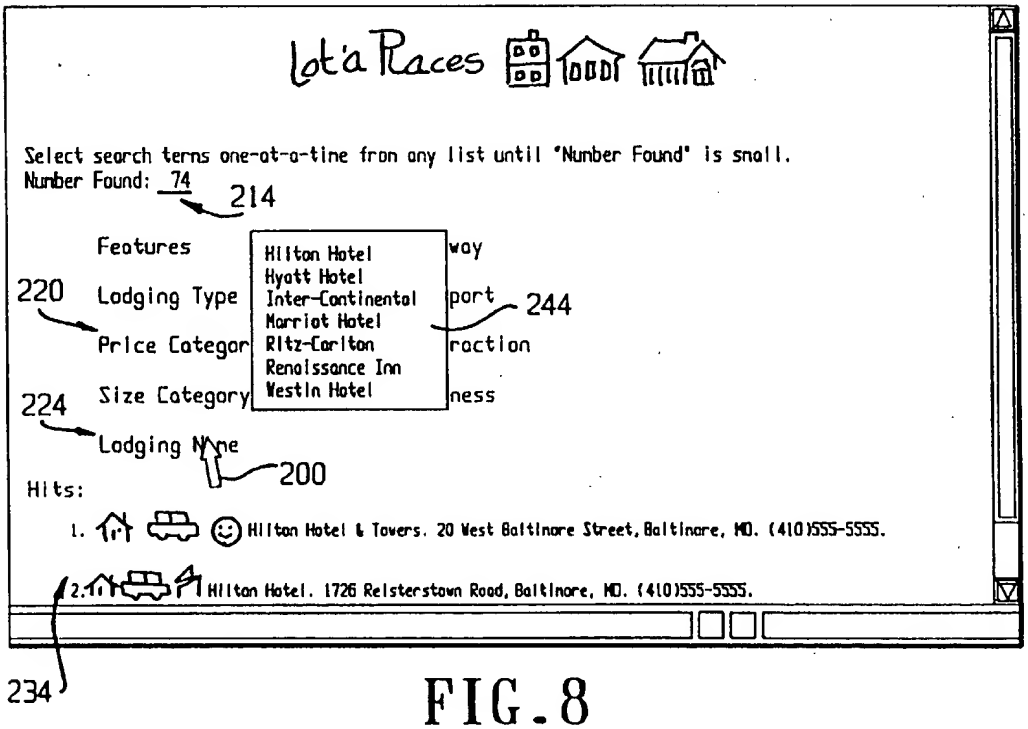

Lot'a Places
Select search terms one-at-a-time from any list until "Number Found" is small.
Number Found: 74
214
Features
220
Lodging Type
Price Categor
224
Size Category
Lodging Name
Hilton Hotel
Hyatt Hotel
Inter-Continental
Marriot Hotel
Ritz-Carlton
Renaissance Inn
Westin Hotel
244
200
Hits:
1. Hilton Hotel & Towers. 20 West Baltimore Street, Baltimore, MD. (410)555-5555.
2. Hilton Hotel. 1726 Reisterstown Road, Baltimore, MD. (410)555-5555.
234

FIG. 8

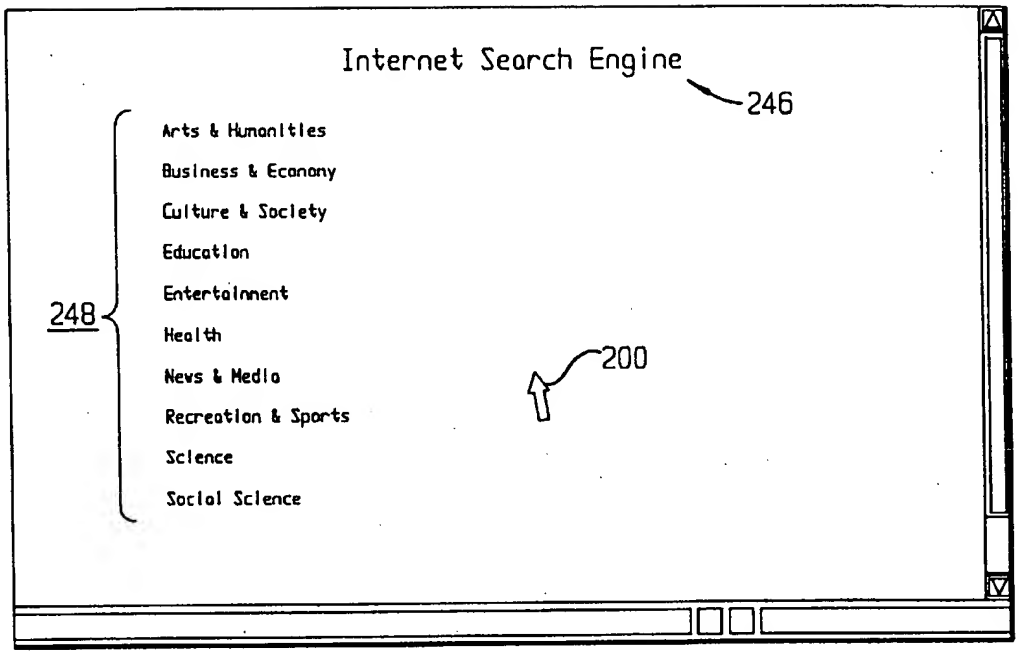

Internet Search Engine
246
Arts & Humanities
Business & Economy
Culture & Society
Education
Entertainment
248
Health
News & Media
Recreation & Sports
Science
Social Science
200

FIG. 9

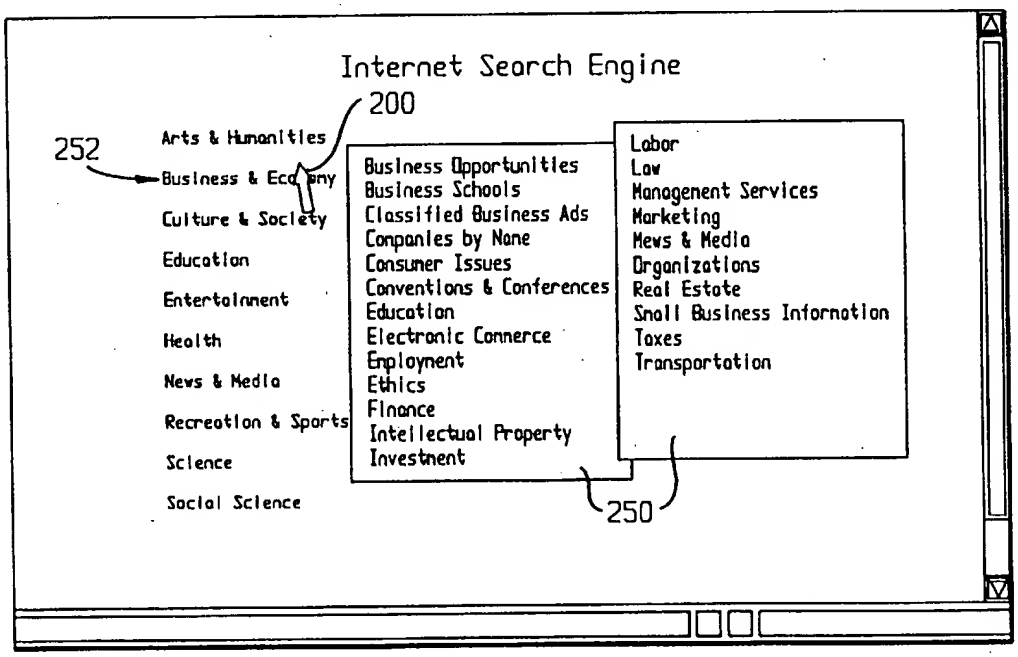

Internet Search Engine
200
252
Arts & Humanities
Business & Economy
Culture & Society
Education
Entertainment
Health
News & Media
Recreation & Sports
Science
Social Science
Business Opportunities
Business Schools
Classified Business Ads
Companies by Name
Consumer Issues
Conventions & Conferences
Education
Electronic Commerce
Employment
Ethics
Finance
Intellectual Property
Investment
Labor
Law
Management Services
Marketing
News & Media
Organizations
Real Estate
Small Business Information
Taxes
Transportation
250

FIG. 10

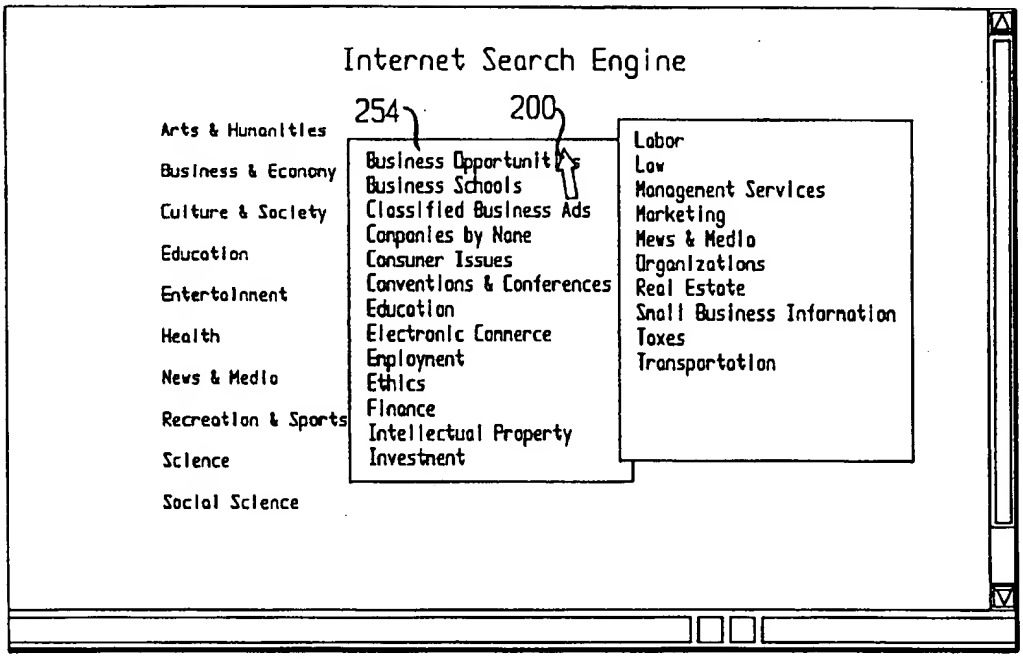

Internet Search Engine
254
200
Arts & Humanities
Business & Economy
Culture & Society
Education
Entertainment
Health
News & Media
Recreation & Sports
Science
Social Science
Business Opportunities
Business Schools
Classified Business Ads
Companies by Name
Consumer Issues
Conventions & Conferences
Education
Electronic Commerce
Employment
Ethics
Finance
Intellectual Property
Investment
Labor
Law
Management Services
Marketing
News & Media
Organizations
Real Estate
Small Business Information
Taxes
Transportation

FIG. 11

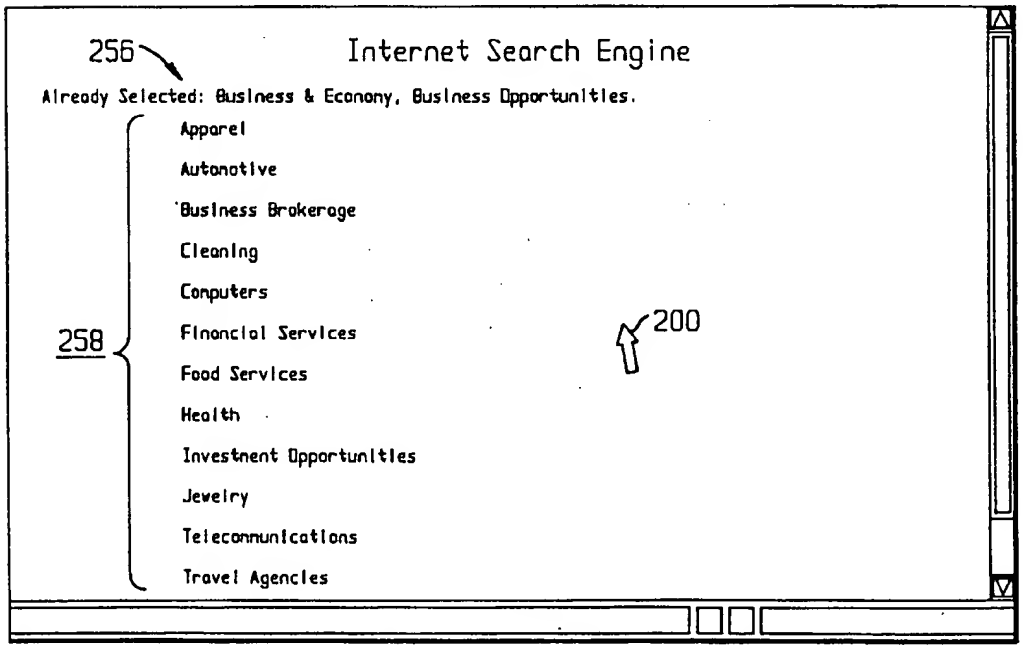

256
Internet Search Engine
Already Selected: Business & Economy, Business Opportunities.
258
200
Apparel
Automotive
Business Brokerage
Cleaning
Computers
Financial Services
Food Services
Health
Investment Opportunities
Jewelry
Telecommunications
Travel Agencies

FIG. 12

SEARCH SYSTEM HAVING USER-INTERFACE FOR SEARCHING ONLINE INFORMATION

BACKGROUND OF THE INVENTION

Information is available in quantities significantly larger than has ever been known in human history. For example, EXCITE, one popular search engine on the World Wide Web, now claims to routinely examine and index 250 million pages of online information and to consider another 500 million pages for possible inclusion in the EXCITE search system. Information is also available to more people than ever before in human history. The use of electronic information has increased more than a thousand fold since 1990.

Interface technology that assists searchers in locating target information from all available information is still evolving. One popular method for finding information online is a Key Word search. A user types a word or words in a search box provided for this purpose. The word(s) typed are used to search all available documents and return "hits" to the user. Most modern online electronic search engines, including well known search sites such as ALTAVISTA and LYCOS, include Key Word searching.

A second popular method for finding information is by presenting a Directory. Typically, Directory searching involves presenting a list of categories. The user selects from among the choices that are displayed. Additional, more specific, search terms are then presented and selected by the user. The search process is organized hierarchically so that a selection from one category leads to a set of other choices contained within that category. A user moves down the "branches" of the directory "tree" until they find the information they want. YAHOO and MICROSOFT NETWORK are examples of the many publicly available electronic search engines that provide Directory listings.

Cochran describes non-hierarchical searching in U.S. Pat. No. 5,768,581, which is herein incorporated by reference. Instead of moving down a Directory tree, a user selects search terms from several search categories that are not organized in a branching tree structure. Selecting from one category does not eliminate the possibility of selecting from other categories because categories are mutually exclusive, unlike Directory searching.

Cochran et al., in U.S. Pat. Nos. 4,879,648 and 5,206,949 herein incorporated by reference, describe two distinct ways of developing lists of search terms. Static lists are developed "logically" from what is already known about how information is organized and used. Static lists are constructed from theory and/or the expected use of the information and are prepared in advance of use of the lists. Static lists do not require a search through the information source, and remain the same unless a list of terms in the program itself is edited. For instance, a static list may be an alphabetical list of city names in a company's service area. It is relatively unchanging and can be constructed by management personnel in advance of any search.

Dynamic lists, on the other hand, are developed by an active search of the information under consideration. Dynamic lists vary over time as the information source changes, and may change frequently. For instance, a dynamic list may be an alphabetical list of the names of people who have enrolled in an online promotion. The list changes from minute to minute as people sign up. The Cochran patents describe one way of constructing static and dynamic lists.

All online information search systems that display selectable is search terms are relatively slow. It often takes more than a minute to select multiple search terms from a Directory or non-hierarchical search system. A user must click repeatedly to scroll lists, to move down a page or to change pages in order to find the information they are looking for. People have the capacity to look at choices much faster than the choices are presented by these displays. As more users search more and larger sources of online information, there is a tremendous loss of time waiting for computer displays to catch up with the human ability to scan and select.

The relative slowness of presenting search terms is not a function of search speed or communication speed. Computer hardware and communication bandwidth is now sufficient for quick interactions. The slowness of search technology is caused mainly by inadequate user-interface technology.

A method for rapidly locating pages on a web site is shown, for instance at www.sherwin.com, which is operated by The Sherwin-Williams Co. The site describes products and services offered by The Sherwin-Williams Company. One page, Products and Services, at www.sherwin.com/productsservices/default.asp, shows several menus and sub-menus that function as hyperlinks to other pages within the Sherwin-Williams website. Sub-menus that are not initially visible are displayed when a cursor is moved over a displayed menu items, which is referred to as a "mouse over". The display makes hyperlinks within it's website available quickly, in a relatively small amount of space.

However, the Sherwin-Williams website is not a search site and is not used to search a database or other information source. The site provides hyperlinks to individual pages within the Sherwin-Williams website. When a user has made one choice on sherwin.com/productsservices/default.asp, a different page is displayed and no additional choices are possible.

With the Sherwin-Williams technology, a user cannot access information from a database of information. A user cannot make successive choices to refine their selection as they would with a Directory or non-hierarchical search. When the user selects any hyperlink, the user is then presented with a different page. The different page does not offer any menu choices as on the Services and Products page. There is no database search function associated with the display on the Sherwin-Williams site.

Accordingly, there is a need to facilitate and speed up the presentation and selection of search technologies. This, in turn, will substantially increase the commercial value and practicability of online searching.

SUMMARY OF THE INVENTION

It is an object of the present invention to reduce the amount of time needed to display and select search terms from any user-interface that displays search terms. It is an object of the invention to eliminate or minimize features that add unneeded complexity to a display. This includes eliminating the use of scroll bars, task bars and graphics that must be clicked to signal page reorganization or page changes. It is also an object of the present invention to eliminate the need for any mechanical activity on the part of the user that interferes with the users ability to scan large numbers of search terms and select search terms quickly.

Users may scan and select quickly without the need to interpret a variety of icons and instructions and without the need to perform more than the minimum number of physical actions. The user is not slowed down by pick boxes, scrolling pages, scrolling lists of hyperlinked terms or selecting functions from a task bar, as required by conventional systems.

These goals are achieved by presenting search terms that are meaningfully organized and then advancing the display of choices when a mouse or other pointing device passes over specific parts of the display screen. The display changes quickly to reveal different or additional search terms. If the user wants a list that is displayed to be removed from the visual display, the user simply moves the pointing device to a "blank" area of the display screen.

The present invention reduces, and almost eliminates, the clicking, scrolling and page reorganization that has been required by search directories and non-hierarchical search systems heretofore. Hence, mechanical actions and unnecessary decision making that slow the selection of search terms are eliminated. The display of graphics is simplified so the user's attention is not distracted from the process of scanning and quickly selecting search terms.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows a general configuration of a computer network used in accordance with the present invention.

FIGS. **2***a*–**2***c* are flow charts showing the decision rules for implementing the invention.

FIG. **3** shows a preferred embodiment of the invention, an online database for searching a lodging database.

FIGS. **4**–**6** show the displays of three lists from the lodging database.

FIG. **7** shows the selection on one of the displayed terms.

FIG. **8** shows the effect of the selection of the term in FIG. **7**.

FIG. **9** shows an alternative preferred embodiment of the invention, an Internet Search Engine.

FIG. **10** shows the display of Category Names on the Search Engine.

FIG. **11** shows the position of the cursor when selecting a term from a Category.

FIG. **12** shows a sub Category list.

FIG. **13** shows search terms that are displayed after selecting a sub-Category.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In describing a preferred embodiment of the invention, specific terminology will be resorted to for the sake of clarity. However, the invention is not intended to be limited to the specific terms so selected, and it is understood that each specific term includes all technical equivalents that operate in a similar manner to accomplish a similar purpose.

As user herein, the phrase, "search term" generally refers to any word, symbol or phrase that can be selected by a user. Search terms are used to search electronic information for the purpose of identifying and locating parts of information of interest to the user. The word "category" generally is used to refer to a group of search terms that are logically related. In some situations, the category name itself may also be a search term.

A display device is a computer, television terminal, hand-held electronic device or any implement that allows a user to interact with a visual representation of an information source. A pointing device is a cursor, track ball, touch pad, pen light or other implement used to interact with iconic images and information displayed on a display device. An information source may be original information, in the form of a database or other collection of records, or it may be a secondary source that reorganizes original content in order to make it easier to search and retrieve information. When there are large quantities of information, the information is preferably stored on a server.

The system and method of the present invention is implemented by computer software that permits the accessing of data from an electronic information source. The software and the information in accordance with the invention may be within a single, free-standing computer or it may be in a central computer networked to a group of other computers or other electronic devices. The information may be stored on a computer hard drive, on a CD ROM disk or on any other appropriate data storage device.

FIG. **1** shows a simplified representation of a preferred overall implementation of the invention in a computer network **100** in accordance with the preferred embodiment. A plurality of client computers **120** are networked to a remotely located server **110** by a communication link **150** and bi-directional communication lines **130**.

Client computers **120** contain, at a minimum, memory **121**, processing capability **123**, a display device **125** and a pointing device **127**. The server contains at a minimum, storage capacity **112**, memory **116** and processing capability **119**. As a practical matter, the server also has a display device **117** and a keyboard (not shown).

The Communication Link **150** and the communication lines **130** provide two way communication between clients **120** and the server **110**. The link is established when a client **120** accesses the server at its electronic address **118**. This is done, for example, by entering the Internet address of the server **118** using any Web Browser software.

Programing language may be imbedded in the Browser to allow some of the processing required by the invention to be done on the client rather than having all of the programming done on the server. JavaScript, which was developed by Netscape Communications Corporation, is a well known language used to embed programming code into html documents. In addition, memory space **116** is optionally allocated so that server **110** may retain the status of search requests generated by individual computers **120** during any individual search session.

FIGS. **2***a*–**2***c* are a generalized overall method of finding information from an electronic information source in accordance with the preferred embodiment of the invention. For illustrative purposes specific examples will be discussed with respect to FIGS. **3**–**12**.

Category Names can be generated as either static or dynamic lists **10**. If they are dynamic ("yes" at **10**), a search is made of the information source and a list of search terms is generated **11**. If the first list of Category Names exists as a static list ("no" at **10**), the Category Names are identified **12**.

Initial lists of Search Terms for each category may be static or dynamic **13**. If they are dynamic, a search is made of the information source and a list of terms is generated **14**. IF the first list of search terms exist as a static list, the search term lists are identified **16**. Category Names and lists of Search Terms associated with each Category Name are sent to the client **18** along with graphics and other information needed to display the page on which the search for information is to take place. Embedded programming code may also be sent to the client.

Continuing with FIGS. **2***b* and **2***c*, Category names are displayed with graphics and other information **20**. Search Terms are displayed when the pointing device passes over a Category Name **22**. The search terms are displayed quickly, using "mouse overs" to test the position of the pointing

device. That is, when the pointing device is passed over a Category Name, the list of search terms appears on the screen "automatically". It is not necessary to activate the pointing device by, for example, clicking a cursor in order to display the list of search terms. Lists change when the pointing device is moved to cover any Category name. If the pointing device is not over a Category Name, no list is displayed.

To select a term and proceed ("yes" at **24**), it is necessary to activate the pointing device **24**. If a cursor is being used, the left button of a cursor is clicked on one of the terms to select that term. Activating the pointing device results in a search of the information source **25**. There may be no more search terms from which to choose ("No" at **26**) and the program is finished **28**.

However, in more complex situations, additional choices are possible ("Yes" at **26**). If the search design is hierarchical, as is the case with a Directory, Category Names are likely to change ("Yes" at **32**), because, by definition, Directories narrow the range of choices by moving to smaller and smaller divisions of the domain. Those divisions have different sub-category names. If the design is non-hierarchical, Category Names are not likely to change ("No" at **32**) because in a non-hierarchical search, the search terms are reduced without necessarily changing the categories.

If Category Names change ("Yes" at **32**), a new list of Category Names is generated. At step **34** the program determines whether the Category Names are at the server, or the client and whether they are static or dynamic **35, 37**. If they are dynamic, the new list of Category Names is then generated at the server **38** or the client **36**. If the Category Names are generated at the server, they are transmitted to the client **40**. If Category Names do not change ("No" at **32**) the program examines the status of the search terms **42** and proceeds.

Lists of Search Terms may not change ("No" at **42**), in which case the user may select again **24**. However, lists of Search Terms often do change ("Yes" at **42**). New lists of Terms may be generated on the sever ("Yes" at **44**) or the client ("No" at **44**). At steps **46** and **50**, the system determines whether the Search Term lists are dynamic or static. If lists are dynamic, a search will be required **48, 54**. If the new Terms are generated on the server, they are transmitted to the client **52**. All list of new terms are ultimately available to the user **22**.

This design provides maximum flexibility for search situations. The system may be used with hierarchical Directories and non-hierarchical search systems. The system may also be implemented as a server-based system, as a client-based system or as a combination of both.

Users can manipulate the search process multiple times, very quickly, until the desired information is identified. Once a term is available ("Yes" at **26**), every path in the flow chart returns to display Category Names and/or Lists **20, 22**. Terms will be displayed rapidly in a small amount of space without repositioning the screen display.

FIG. **3** shows a preferred embodiment of the current invention, a non-hierarchical search system for finding lodging locations in the United States. FIG. **3** is a second display at a web site named Lot'a Places (www.lotaplaces.com). Prior to seeing the display in FIG. **3**, a user selected from a page that presented choices about the location of the lodging.

In the example that is used here, the state of Maryland was selected on the prior page. Once a State is selected, the preferred embodiment identifies static Category Names on the server, steps **11, 12**, and Search Term lists. As described below, some lists are static and some dynamic, **13, 14, 16**. The Category Names and Search Term lists are transmitted to the client **18** and the Category Names are displayed **20** as shown in FIG. **3**. A logo **210**, as well as directions **212** of how to proceed, may optionally be displayed.

The number of "hits" or listings in Maryland from which to choose **214** are displayed. Here, the total number of listings for Maryland is **402**, as indicated. Nine Category Names appear in two columns **216–232**. In this embodiment, **218, 220** and **222** have lists that are static. Each search term that appears in the list is known in advance of the search since the search terms are always the same. The six other lists are dynamic, and thus will be different for New York and other states than they are for Maryland. They are obtained by searching the information source.

The non-hierarchical search system at Lot'a Places is organized so that any of the nine categories can be used to reduce the number of hits from **402** to some smaller number. Near the bottom of the display, the beginning of an alphabetical list of the current hits is displayed **234**. (The invention does not require hits **234** to be displayed as searching progresses. As an alternative, hits may only be displayed when requested by the user.) The cursor **200** is on an "empty" part of the screen so that no lists of search terms are displayed.

FIG. **4** shows the same display when the cursor **200** is passed over the Category Name, Features **216**. A list of search terms for the category, Features, is displayed **236**, step **22**. The search terms are displayed "over" or "on top of" the original html page. Variations in page color or texture can be used to indicate that some material rests "on top of" other material.

If the user moves the cursor to some "empty" place on the display, the list disappears. The user can then put the cursor over another category **218–232** and see another list. Alternatively, the user may click on one of the search terms in the list **24** and execute a search, step **25**.

FIG. **5** shows a second list of search terms **238**. This list is displayed when the cursor **200** is passed over the category, Lodging Name **224**. The list is removed if the user moves the cursor off the category name. FIG. **5** also shows the word "more" in the last position of the second column **240**. If the user passes the cursor over this term, additional search terms in the same category are displayed. The use of the "more" option makes large numbers of choices available in a small amount of space at a fastest possible speed. The "more" option may be used multiple times within a list to display multiple pages.

FIG. **6** shows a list of Search Terms **242** that is displayed when the cursor **200** is over Price Category **220**. FIG. **7** shows the position of the cursor **200** on the list of search terms **242** when it is used to select the search term, Upscale, from the Price Category **220**.

FIG. **8** shows the results of selecting Upscale at step **24** in FIG. **7**. A number of changes have taken place. A search of the database was conducted when the term, Upscale was selected, step **25**. Instead of there being **402** hits in Maryland, there are now seventy-four hits, as shown at **214**. The seventy-four hits that were selected correspond to lodging in Maryland rated with an upscale price (rather than Mid-range or Economy price, for example). The alphabetical list of hits has changed **234** to show only upscale properties.

At this point, the system determines if additional search terms are available amongst the Categories, step **26** and if

the Category Names, have changed **32**. In this example, Price Category **220** has been muted to show that the category is no longer available for selection during this search. In the present example, search terms are available in each of the remaining (non-muted) Categories **216–218, 222–232**. When the cursor **200** is passed over the Category Name, Lodging Name **224**, the list **244** is considerably shorter than the list of Lodging Names displayed in FIG. **5**. Lodging Names are now only the names in Maryland that are rated with an Upscale price. When the search was conducted as illustrated in FIG. **7**, the domain under consideration was reduced from **402** hits to **74** hits and all dynamic lists of search terms were updated.

A distinguishing feature of this invention is the quickness and fluidity of the selection process. This quickness and fluidity can be achieved even when space needed for lists of search terms exceeds the display space of the computer screen. There are no scroll bars and no pick boxes that change the display of search terms on this single, stable page.

"Mouse overs" allows a list to be displayed when the cursor is passed over a Category Name, and is used in the present invention to obtain a quick and stable selection process. In addition, search terms are passed to the client or created on the client, and held in readiness on the client until the user passes the cursor over a Category Name to display a list of Terms. Actual searches of an information source such as a lodging database are planned so that new and additional information will flow to the user at appropriate times during the selection process. The downloading of lists and programming code is balanced to minimize delays experienced by users.

FIGS. **3–8**, for the Lot'a Places Lodging search, illustrate the current invention applied to a non-hierarchical search system. FIGS. **9–13**, illustrate the use of the current invention when the search system is a hierarchical Directory. FIG. **9** shows the first page of an Internet Search Service. A title **246** appears at the top of the page. Category Names **248** preferably are displayed in a single column on the left side of the page. The cursor **200** is not covering any Category Names. Therefore, no lists of search terms are displayed.

FIG. **10** shows the list of search terms **250** that are displayed when the cursor **200** is passed over the name, Business & Economy **252**. Search terms from any of the other Category Names will be displayed in the same way if the cursor is passed over those names. Lists are all available on the client and can be displayed by moving the cursor to the appropriate position. FIG. **11** shows the position of the cursor **200** as the user selects Business Opportunity **254**, the first Search Term in the list.

FIG. **12** shows the result of clicking on the Search Term, Business Opportunity **254** in FIG. **11**. A visual display of the Category and sub-category that was selected is presented at step **256**. The search returns another list of Categories **258**, which is displayed in place of the list of Category Names in FIGS. **9**, **10** and **11**. As described in connection with the flow chart, FIGS. **2***a* and **2***b*, Category Names sometimes change. In particular, Directories, like the Internet Search Engine in this figure, are likely to create subdirectories of additional Categories as the search process moves down the branches of a Directory tree. In this case, the result of selecting Business Opportunities **254** is a subdirectory that gives names of Business Opportunities. Passing the cursor over these terms may result in other subcategories or it may display a list of hits. FIG. **13** shows the result of passing the cursor over Investment Opportunities in the Business Opportunities sub-category.

Accordingly, non-hierarchical designs (FIGS. **3–8**) and Directories (FIGS. **9–13**) have different advantages and disadvantages. Yet, both operate more quickly with this new technology. The preferred embodiment uses a Java applet to manage the online display. The applet sets the maximum number of rows to be displayed in each column of search terms. It also sets the maximum number of columns and column width.

The display technique of the present invention may also be implemented for e-commerce purchasing and corporate information systems. In addition, the system may be used in a local computer environment, such as searching files in local storage.

It is not desired to limit the invention to the specific examples shown and described. Rather, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

I claim:

1. A method for searching an electronic information source using a display device and a pointing device displayed on the display device, the method comprising:

displaying search category names on the display device;

enabling the user to display a list of search terms associated with a category name by passing the pointing device over any of the displayed category names; and

enabling the user to select one of the displayed search terms.

2. The method of claim **1**, wherein the pointing device comprises a mouse having a button, and the step of enabling the user to display a list of search terms does not require the user to operate the button.

3. The method of claim **1**, further comprising enabling the user to display a different list of search terms by passing the pointing device over a different category name.

4. The method of claim **1**, further comprising enabling the user to clear the displayed search terms by moving the pointing device away from the displayed search terms and selected category.

5. The method of claim **1**, wherein at least one list of search terms is updated in response to the user selecting one of the displayed search terms.

6. The method of claim **1**, wherein the information source is located remote from the display device.

7. The method of claim **1**, further comprising searching the information source and retrieving information from the information source in response to said selecting.

8. The method of claim **1**, further comprising displaying on the display device an indicator indicating that additional search terms are available that are not displayed on the display device, and enabling the user to display the additional search terms by passing the pointing device over the indicator.

9. The method of claim **1**, wherein at least one category name changes in response to said selecting.

10. The method of claim **1**, wherein at least one list of search terms is dynamically generated by a search of the information source.

11. The method of claim **9**, wherein the category names are arranged in a hierarchical manner.

12. The method of claim **1**, wherein successive selections reduce available search terms.

13. The method of claim **1**, further comprising searching the information source in response to said selecting.

14. The method of claim **13**, wherein said searching is conducted at a client processor.

15. The method of claim **1**, wherein at least one category name is updated in response to the selecting.

16. The method of claim 1, wherein a search term comprises any word, symbol or phrase used to search information stored in the electronic information source.

17. The method of claim 1, the electronic information source comprises a travel database.

18. The method of claim 1, wherein the step of enabling the user to display a list of search terms enables the user to pass the pointing device over any of the displayed category names in a non-sequential manner.

19. A method for searching a database on a computer having a display device and a pointing device controlling a cursor displayed on the display device, the database associated with at least one of a plurality of categories of information, at least one category having a sub-category of information, the method comprising:

displaying each category on the display device;

enabling the user to select a category by passing the cursor over one of the displayed categories;

displaying on the display device, in response to the user selecting a category associated with sub-categories, each sub-category of information associated with the selected category;

enabling the user to select a sub-category by passing the cursor over one of the displayed sub-categories;

displaying on the display device, in response to the user selecting a sub-category, a list of search terms associated with the selected sub-category;

enabling the user to select one of the displayed search terms; and,

searching the database in response to the selected search term.

20. The method of claim 19, wherein at least one list of search terms is updated in response to the user selecting one of the displayed search terms.

21. The method of claim 19, wherein at least one list of search terms is dynamically generated by a search of the information source.

22. A system for searching a database on a computer from a user terminal including a display device and a manually-operable input unit controlling a cursor displayed on the display device and a select button, the database associated with at least one of a plurality of categories of information, the system comprising:

a computer including a database and a computer processor for accessing the records in accordance with search terms selected at the user terminal:

means for transferring a list of categories and search terms to the display device for simultaneous display of category names associated with each of said categories;

means for enabling the user to select one of the categories by passing the cursor over one of the displayed category names;

means for displaying the search terms associated with the selected category;

means for enabling the user to select one of the displayed search terms; and,

means for searching the available records of the database for records responsive to the selected search term.

23. The system of claim 22, wherein at least one list of search terms is updated in response to the user selecting one of the displayed search terms.

24. The system of claim 22, wherein at least one list of search terms is dynamically generated by a search of the database.

25. A website having a user interface for searching a database of records from a user terminal having a display device and a controller for controlling a pointing device displayed on the display device, the website comprising:

category names displayed on the display device;

means for enabling the user to select a category by passing the pointing device over one of the displayed categories;

a list of search terms displayed on the display device in response to the user selecting a category; and,

means for enabling the user to select one of the displayed search terms.

26. The website of claim 25, wherein the database is located remote from the user terminal, further comprising means for searching the database in response to the selected search term.

27. The website of claim 25, wherein at least one list of search terms is updated in response to the user selecting one of the displayed search terms.

28. The website of claim 25, wherein at least one list of search terms is dynamically generated by a search of the database.

29. A method for controlling a user interface for searching a database from a computer having a display device and a controller for controlling a pointing device displayed on the display device, the method comprising:

displaying category names on the display device;

enabling the user to select a category by passing the pointing device over one of the displayed categories;

displaying a list of search terms on the display device in response to the user selecting a categories; and,

enabling the user to select one of the displayed search terms.

30. The method of claim 29, wherein the method is implemented by a website.

31. The method of claim 29, wherein at least one list of search terms is updated in response to the user selecting one of the displayed search terms.

32. The method of claim 29, wherein at least one list of search terms is dynamically generated by a search of the database.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 6,345,273 B1
DATED : February 5, 2002
INVENTOR(S) : Nancy P. Cochran

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Title page,
Item [56], please add the following patents:

-- **References Cited**

U.S. PATENT DOCUMENTS

5,768,581	6/16/98	Cochran
5,206,949	4/27/93	Cochran et al.
4,879,648	11/7/89	Cochran et al.

OTHER REFERENCES

The Sherwin-Williams Company web site, www.Sherwin.com/productsservices/default.asp, 3 pages (undated)

The George Washington University website, www.gwu.edu, 10 pages © 1999, last modified September 7, 1999.

Samos, "SamosMENU", September 28, 1999, http://www.javaboutique.internet.com/SamosMenu/

Signed and Sealed this

Fourth Day of June, 2002

Attest:

Attesting Officer

JAMES E. ROGAN
Director of the United States Patent and Trademark Office

US006347329B1

(12) **United States Patent**
Evans

(10) **Patent No.: US 6,347,329 B1**
(45) **Date of Patent: *Feb. 12, 2002**

(54) **ELECTRONIC MEDICAL RECORDS SYSTEM**

(75) Inventor: **Jae A. Evans**, Carlsbad, CA (US)

(73) Assignee: **Macneal Memorial Hospital Assoc.**, Berwyn, IL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **09/628,390**

(22) Filed: **Aug. 1, 2000**

Related U.S. Application Data

(63) Continuation of application No. 09/333,170, filed on Jun. 14, 1999, which is a continuation of application No. 08/721, 182, filed on Sep. 27, 1996.

(51) **Int. Cl.**[7] **G06F 15/16**

(52) **U.S. Cl.** **709/202**; 709/205; 345/326; 705/2; 705/3

(58) **Field of Search** 709/202, 205, 709/217; 345/326; 705/2, 3

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,872,448	A	3/1975	Baker
4,315,309	A	2/1982	Coli
5,065,315	A	11/1991	Garcia
5,099,424	A	3/1992	Schneiderman
5,277,188	A	1/1994	Selker
5,416,695	A	5/1995	Stutman et al.
5,659,741	A	8/1997	Eberhardt

OTHER PUBLICATIONS

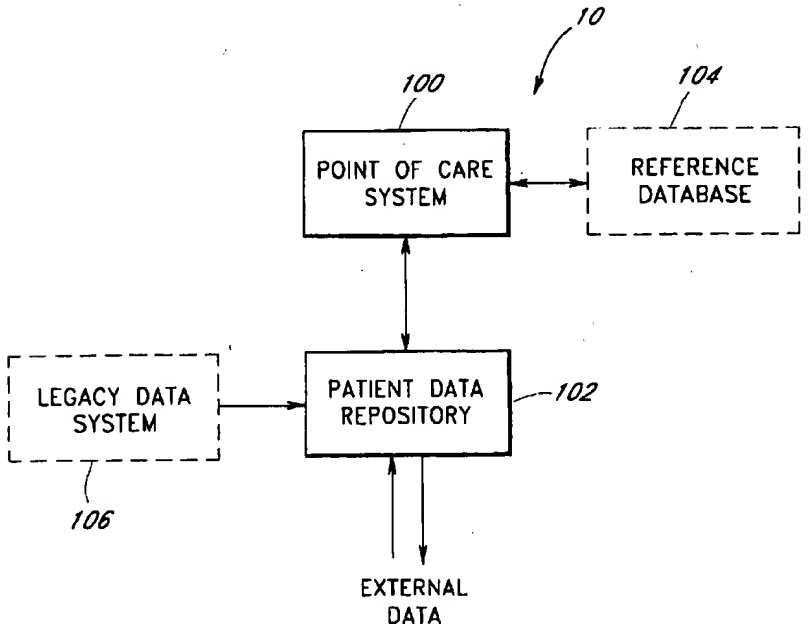
Declaration of Hollon H. Bridges, Jr., dated Sep. 24, 1996.
Declaration of Jae A. Evans, dated Sep. 27, 1996.
Declaration of Marion Neal, dated Sep. 26, 1996.
Declaration of David Printz, dated Sep. 26, 1996.
Kleinholz, et al. "Supporting Cooperative Medicine: The Bermed Project," IEEE MultiMedia, vol. 1, No. 4, Dec. 21, 1994, pp. 44–53.

Primary Examiner—Thomas R. Peeso
(74) *Attorney, Agent, or Firm*—Knobbe, Martens, Olson & Bear, LLP.

(57) **ABSTRACT**

A medical records system that creates and maintains all patient data electronically. The system captures patient data, such as patient complaints, lab orders, medications, diagnoses, and procedures, at its source at the time of entry using a graphical user interface having touch screens. Using pen-based portable computers with wireless connections to a computer network, authorized healthcare providers can access, analyze, update and electronically annotate patient data even while other providers are using the same patient record. The system likewise permits instant, sophisticated analysis of patient data to identify relationships among the data considered. Moreover, the system includes the capability to access reference databases for consultation regarding allergies, medication interactions and practice guidelines. The system also includes the capability to incorporate legacy data, such as paper files and mainframe data, for a patient.

1 Claim, 26 Drawing Sheets



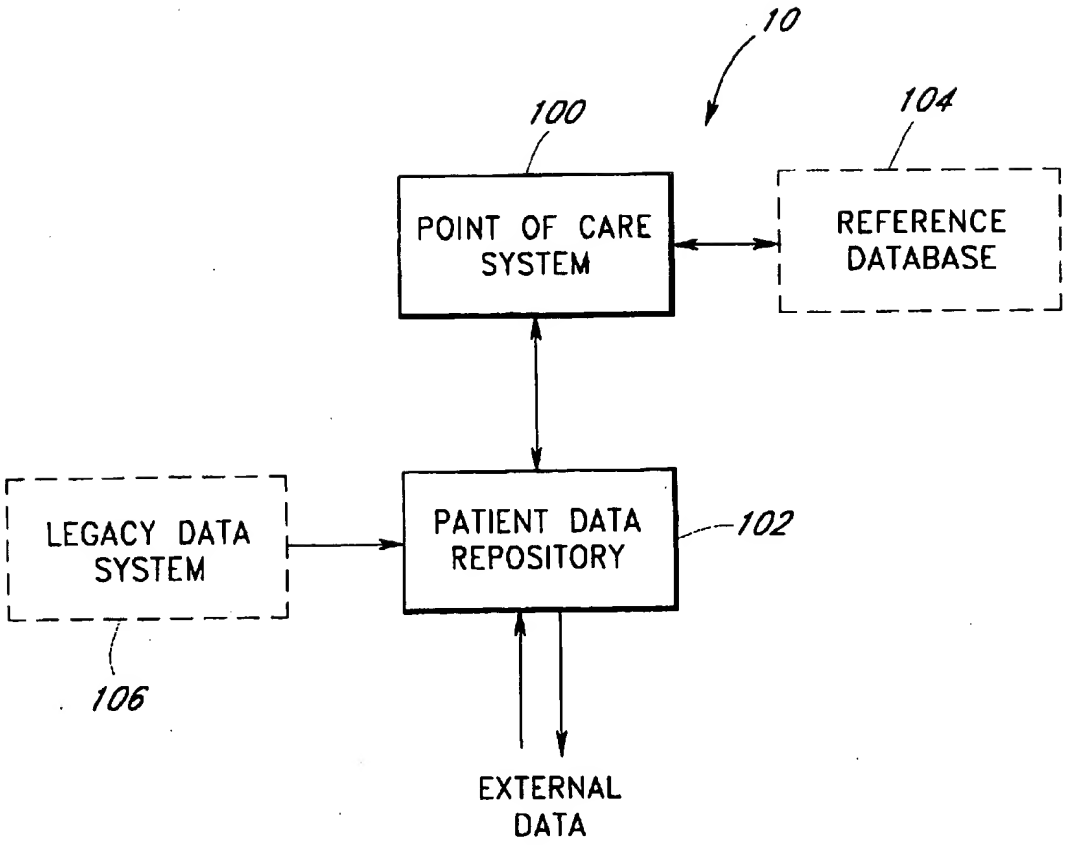

10
100
104
POINT OF CARE SYSTEM
REFERENCE DATABASE
LEGACY DATA SYSTEM
PATIENT DATA REPOSITORY
102
106
EXTERNAL DATA

FIG. 1

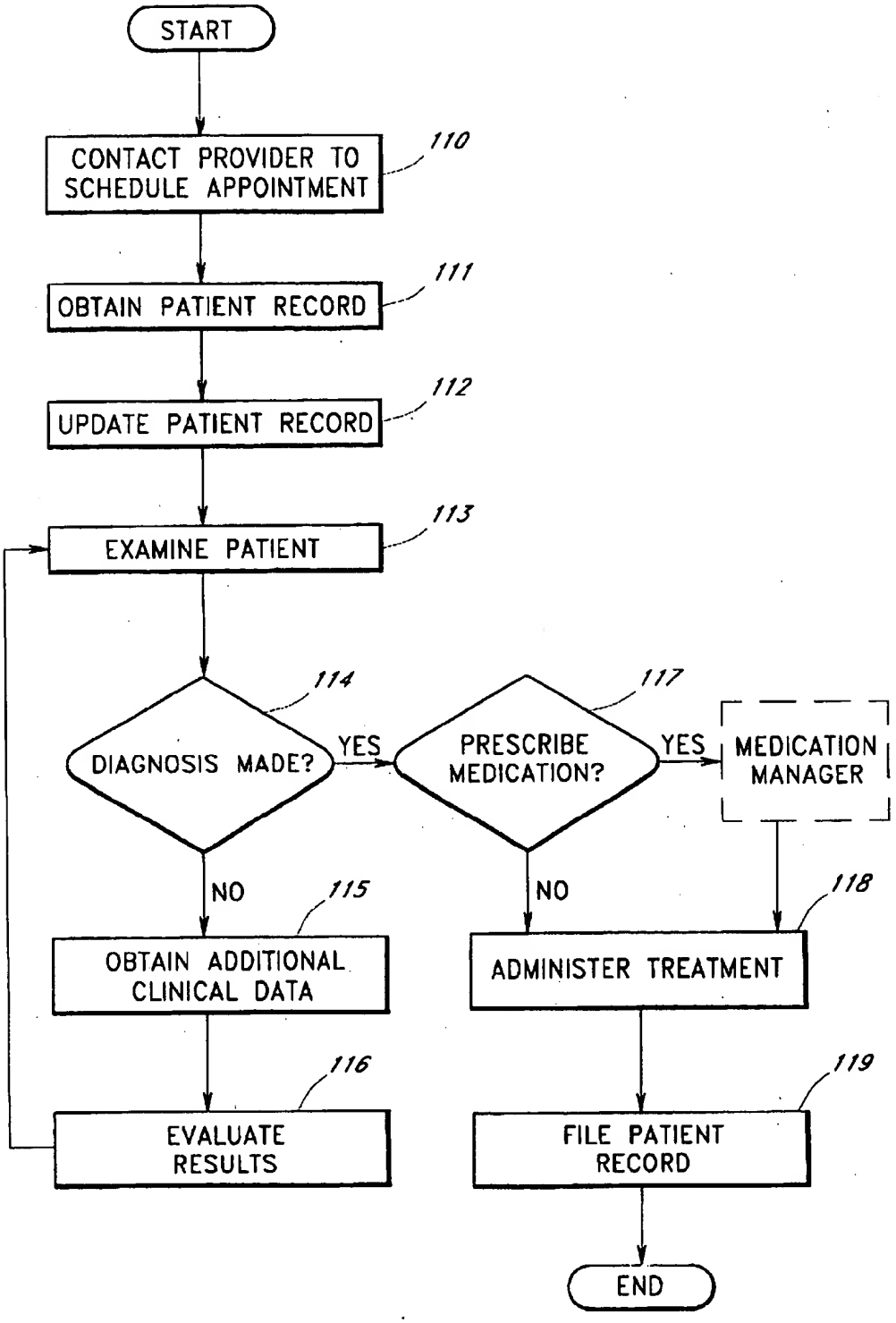

START
CONTACT PROVIDER TO SCHEDULE APPOINTMENT
110
OBTAIN PATIENT RECORD
111
UPDATE PATIENT RECORD
112
EXAMINE PATIENT
113
DIAGNOSIS MADE?
114
YES
PRESCRIBE MEDICATION?
117
YES
MEDICATION MANAGER
NO
115
NO
118
OBTAIN ADDITIONAL CLINICAL DATA
ADMINISTER TREATMENT
116
119
EVALUATE RESULTS
FILE PATIENT RECORD
END

FIG.2

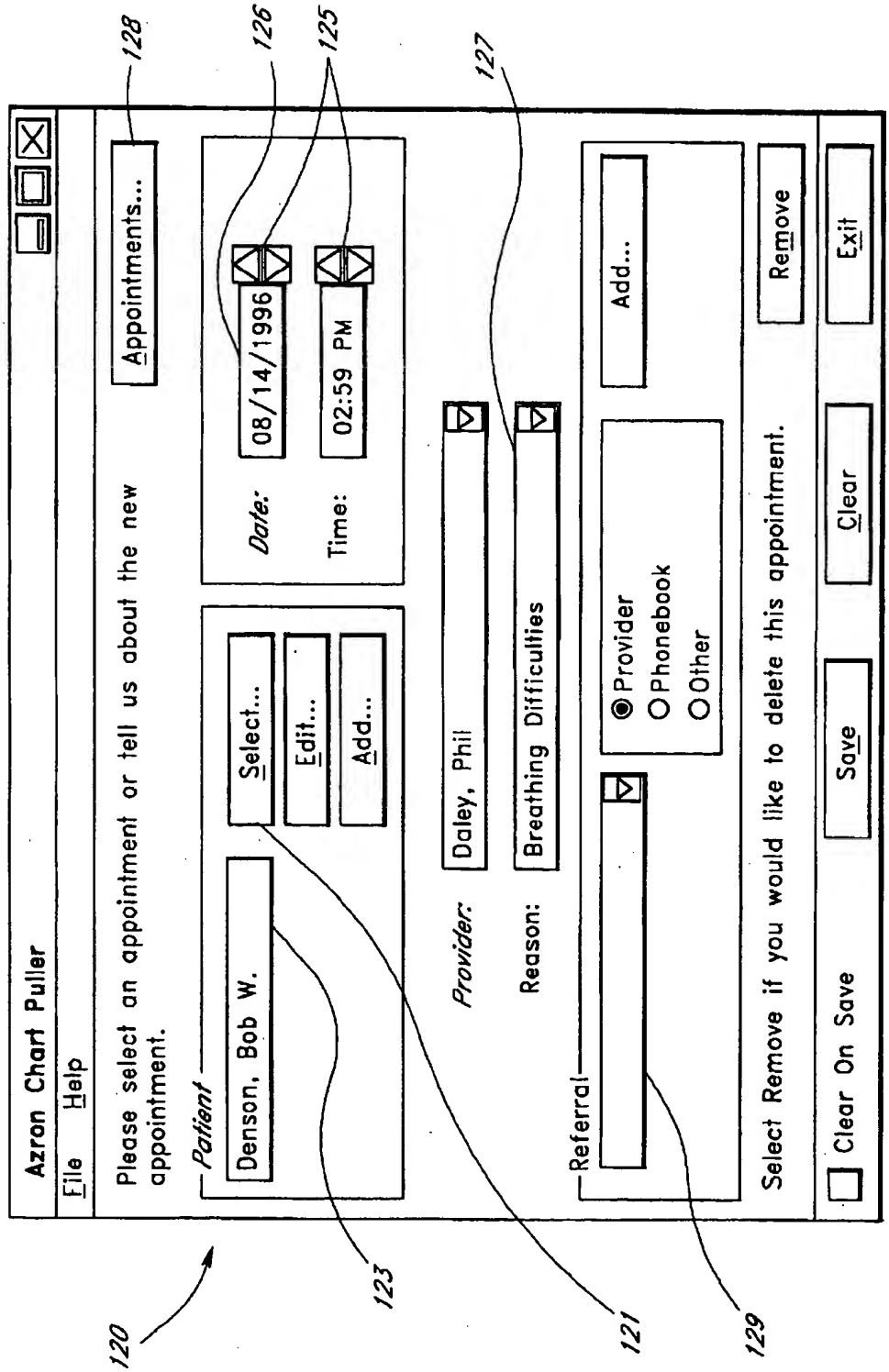

Azron Chart Puller
File Help
Please select an appointment or tell us about the new appointment.
Appointments...
Date:
08/14/1996
Time:
02:59 PM
Patient
Denson, Bob W.
Select...
Edit...
Add...
Provider:
Daley, Phil
Reason:
Breathing Difficulties
Referral
Add...
Provider
Phonebook
Other
Remove
Exit
Select Remove if you would like to delete this appointment.
Clear On Save
Save
Clear
120
123
121
129
125
126
127
128

FIG. 3

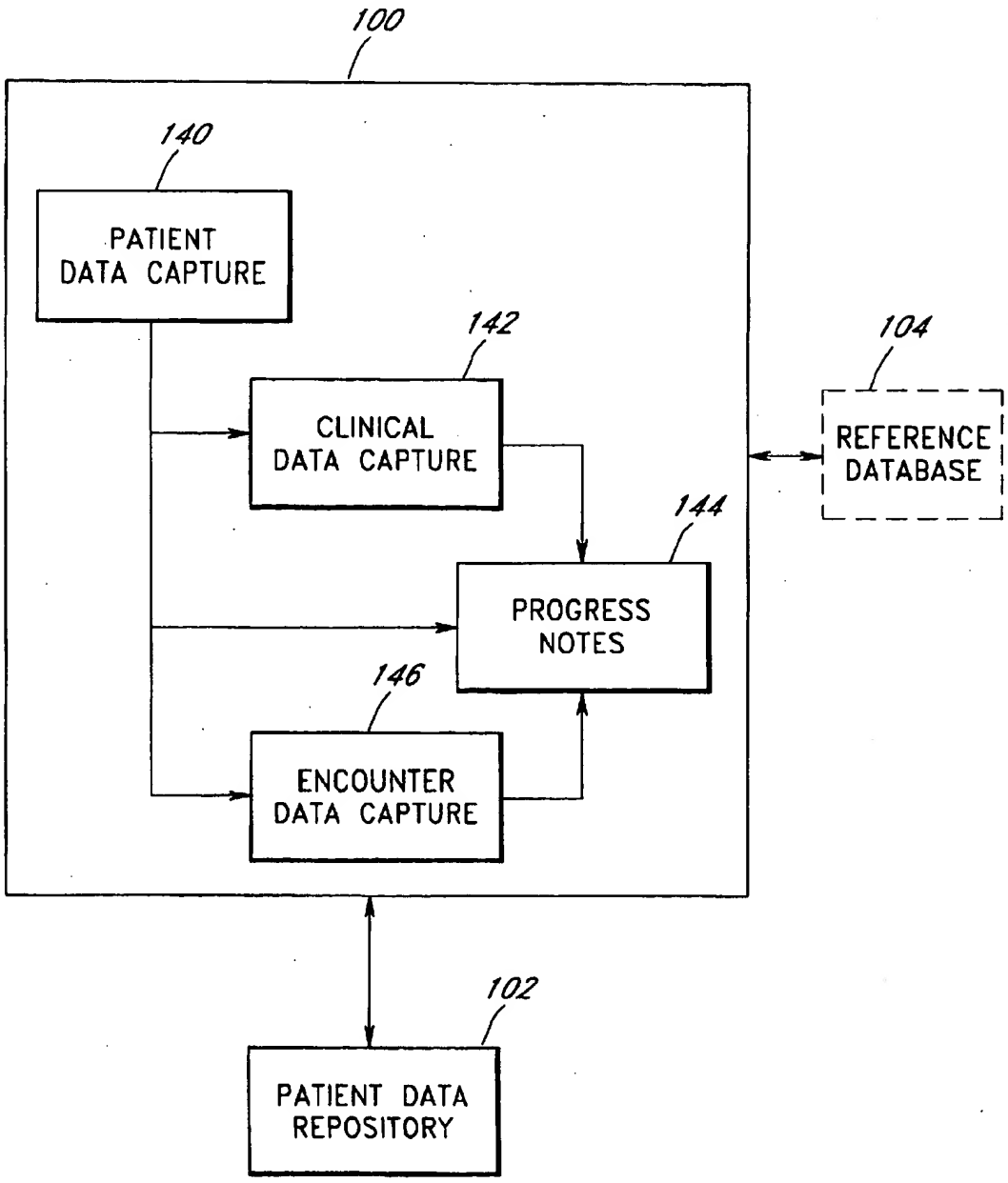

100
140
PATIENT DATA CAPTURE
142
CLINICAL DATA CAPTURE
104
REFERENCE DATABASE
144
PROGRESS NOTES
146
ENCOUNTER DATA CAPTURE
102
PATIENT DATA REPOSITORY

FIG.4

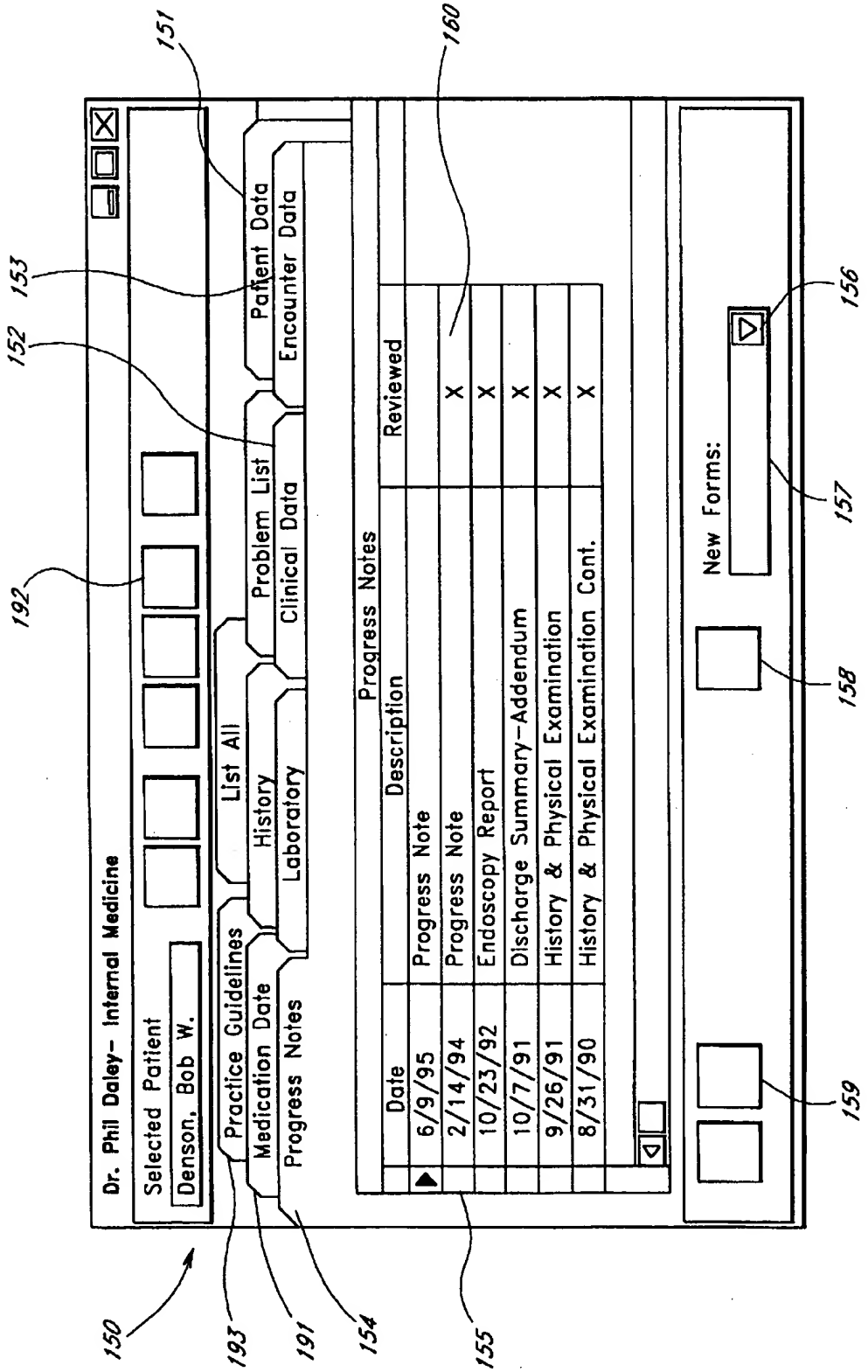

Dr. Phil Daley- Internal Medicine
Selected Patient
Denson, Bob W.
Practice Guidelines
Medication Date
Progress Notes
List All
History
Laboratory
Patient Data
Problem List
Clinical Data
Encounter Data
Progress Notes
Date
Description
Reviewed
6/9/95
Progress Note
2/14/94
Progress Note
X
10/23/92
Endoscopy Report
X
10/7/91
Discharge Summary-Addendum
X
9/26/91
History & Physical Examination
X
8/31/90
History & Physical Examination Cont.
X
New Forms:
150
151
152
153
154
155
156
157
158
159
160
191
192
193

FIG.5

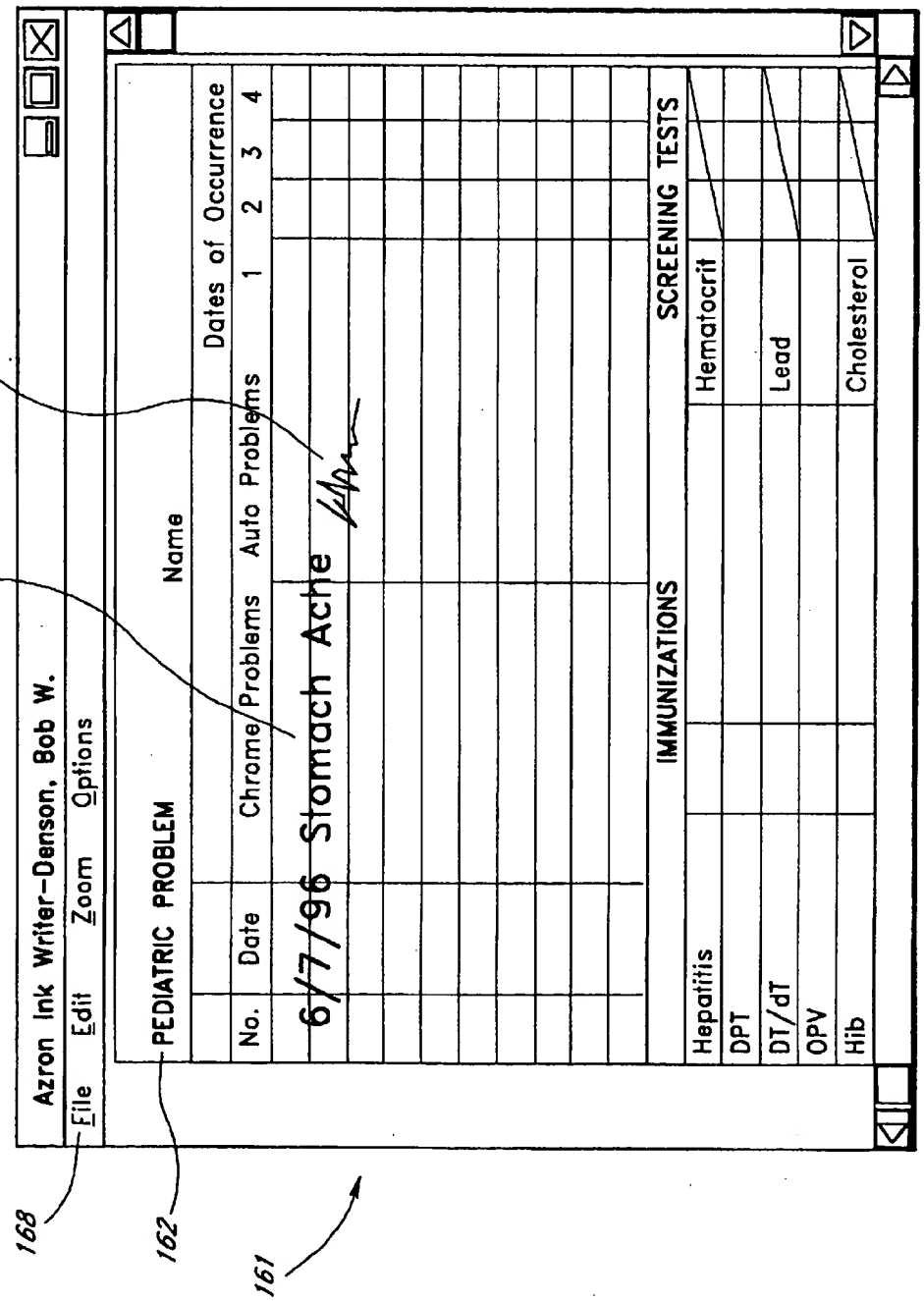

Azron Ink Writer-Denson, Bob W.
File Edit Zoom Options
PEDIATRIC PROBLEM
Name
Dates of Occurrence
No. Date Chrome Problems Auto Problems 1 2 3 4
6/7/96 Stomach Ache
IMMUNIZATIONS
SCREENING TESTS
Hepatitis
DPT
DT/dT
OPV
Hib
Hematocrit
Lead
Cholesterol
166
164
168
162
161

FIG. 6

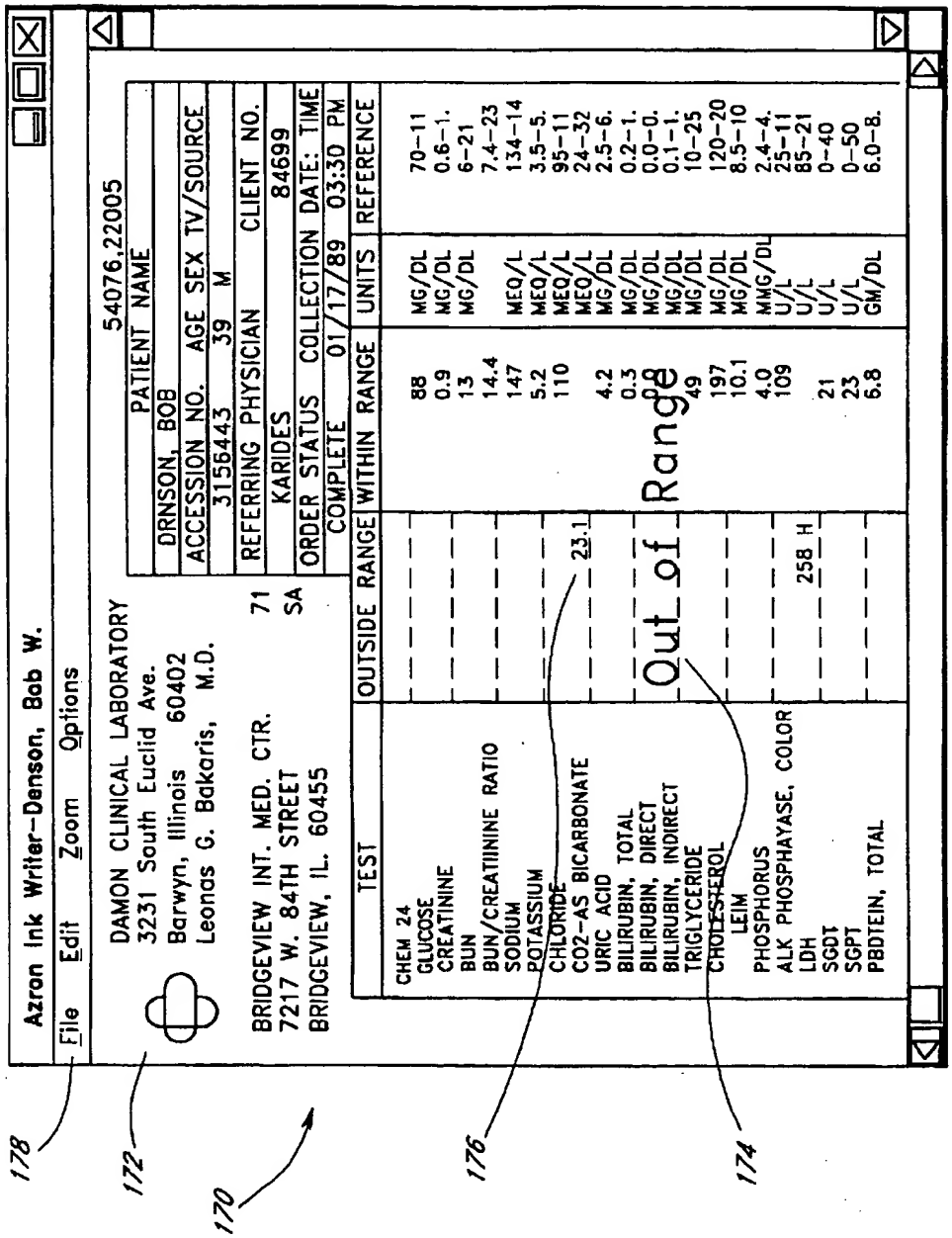

Azron Ink Writer-Danson, Bob W.
File Edit Zoom Options
DAMON CLINICAL LABORATORY
3231 South Euclid Ave.
Barwyn, Illinois 60402
Leonas G. Bakaris, M.D.
54076,22005
PATIENT NAME
DRNSON, BOB
ACCESSION NO. AGE SEX TV/SOURCE
3156443 39 M
REFERRING PHYSICIAN CLIENT NO.
KARIDES 84699
ORDER STATUS COLLECTION DATE: TIME
COMPLETE 01/17/89 03:30 PM
BRIDGEVIEW INT. MED. CTR. 71
7217 W. 84TH STREET SA
BRIDGEVIEW, IL. 60455
TEST | OUTSIDE RANGE | WITHIN RANGE | UNITS | REFERENCE
CHEM 24
GLUCOSE 88 MG/DL 70-11
CREATININE 0.9 MG/DL 0.6-1.
BUN 13 MG/DL 6-21
BUN/CREATIININE RATIO 14.4 7.4-23
SODIUM 147 MEQ/L 134-14
POTASSIUM 5.2 MEQ/L 3.5-5.
CHLORIDE 110 MEQ/L 95-11
CO2-AS BICARBONATE 23.1 MEQ/L 24-32
URIC ACID 4.2 MG/DL 2.5-6.
BILIRUBIN, TOTAL 0.3 MG/DL 0.2-1.
BILIRUBIN, DIRECT 0.0 MG/DL 0.0-0.
BILIRUBIN, INDIRECT 0.1 MG/DL 0.1-1.
TRIGLYCERIDE 49 MG/DL 10-25
CHOLESTEROL 197 MG/DL 120-20
LEIM 10.1 MG/DL 8.5-10
PHOSPHORUS 4.0 MNG/DL 2.4-4.
ALK PHOSPHAYASE, COLOR 109 U/L 25-11
LDH 258 H U/L 85-21
SGOT 21 U/L 0-40
SGPT 23 U/L 0-50
PBDTEIN, TOTAL 6.8 GM/DL 6.0-8.
Out of Range
178
172
170
176
174

FIG. 7

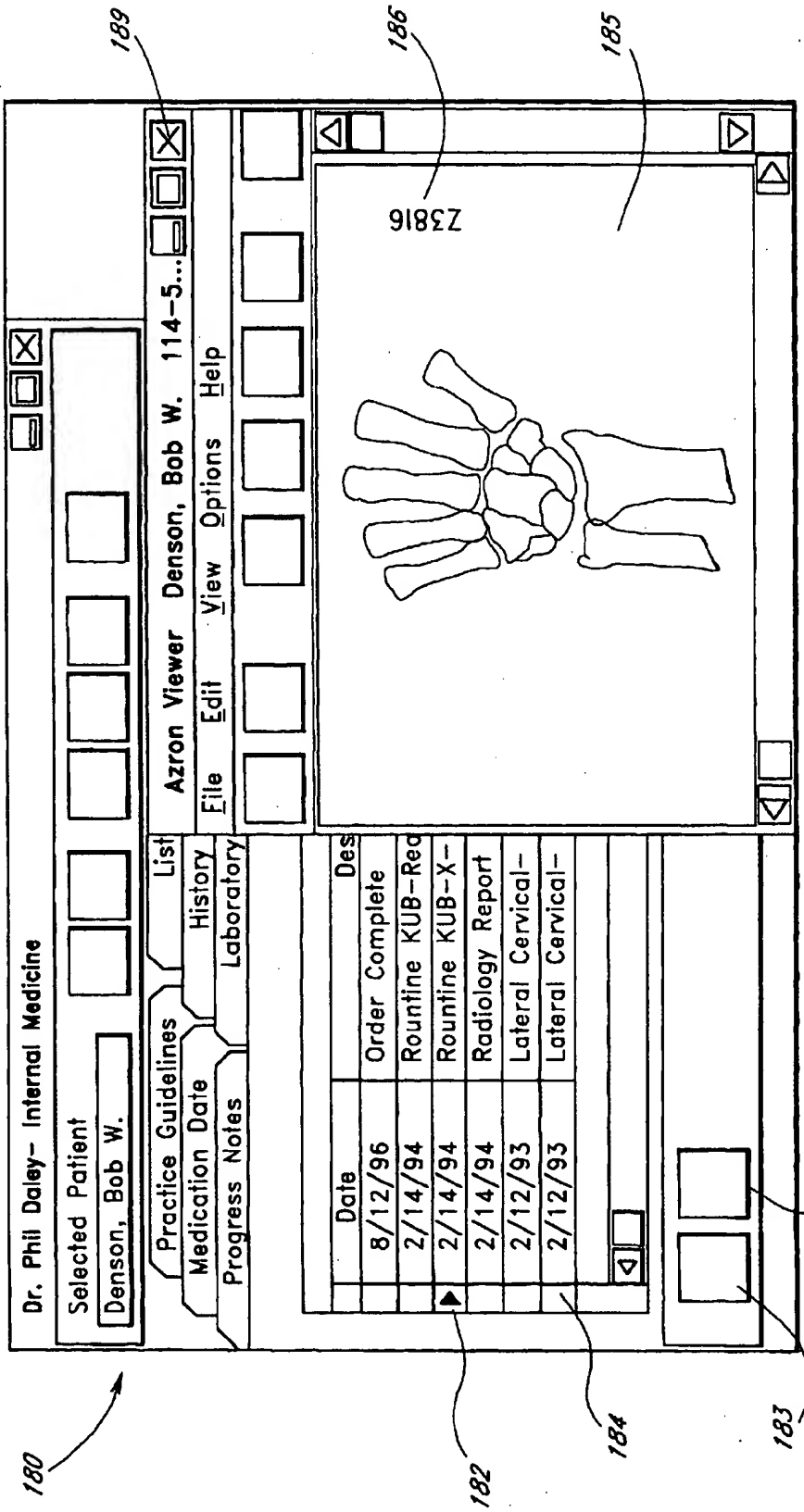

189
186
185
Z3816
Azron Viewer Denson, Bob W. 114-5...
File Edit View Options Help
Dr. Phil Daley- Internal Medicine
Selected Patient
Denson, Bob W.
Practice Guidelines
Medication Date
Progress Notes
List
History
Laboratory
Date
Des
8/12/96 Order Complete
2/14/94 Rountine KUB-Rea
2/14/94 Rountine KUB-X-
2/14/94 Radiology Report
2/12/93 Lateral Cervical-
2/12/93 Lateral Cervical-
187
180
182
184
183

FIG.8

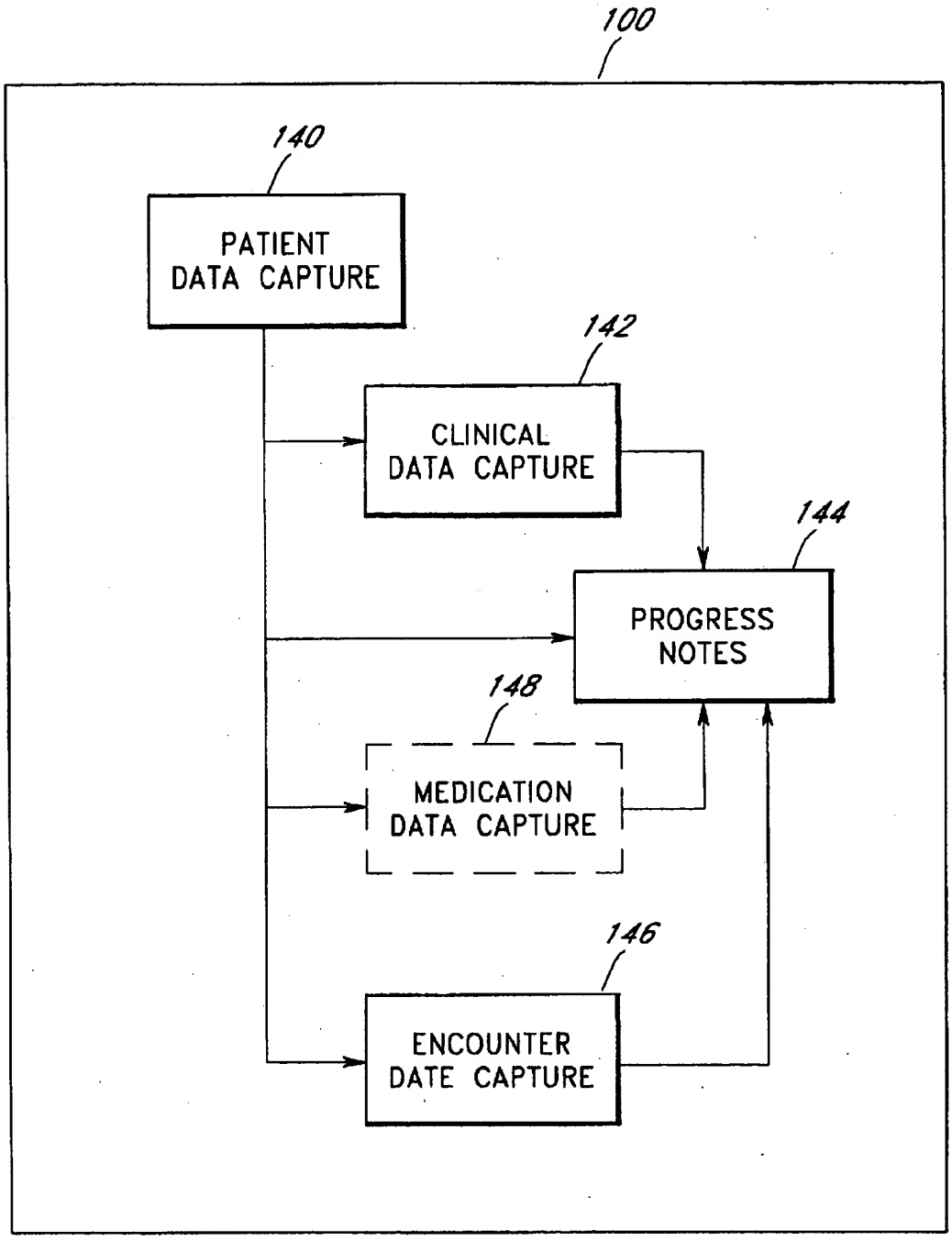

100
140
PATIENT DATA CAPTURE
142
CLINICAL DATA CAPTURE
144
PROGRESS NOTES
148
MEDICATION DATA CAPTURE
146
ENCOUNTER DATE CAPTURE

FIG. 9

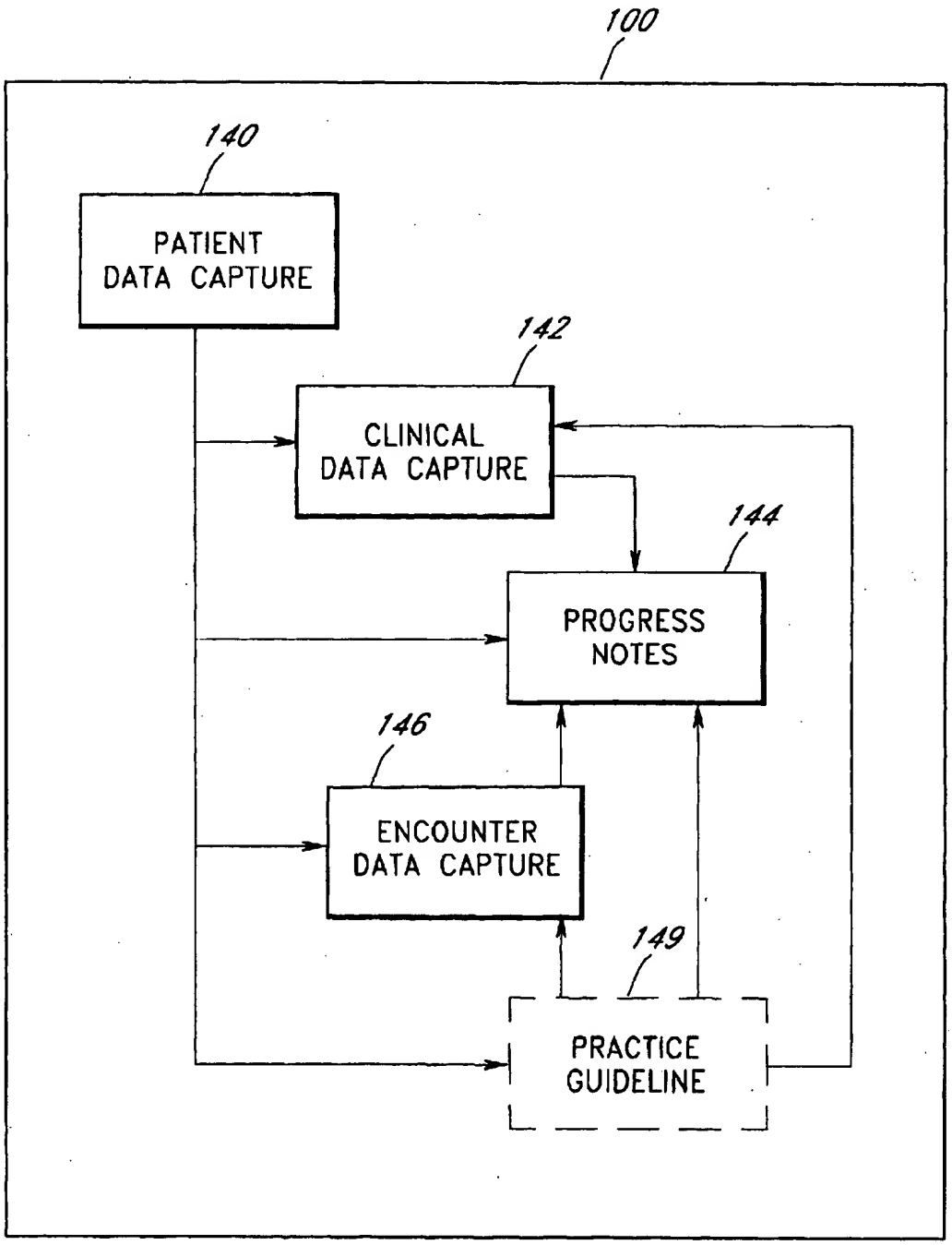

100
140
PATIENT DATA CAPTURE
142
CLINICAL DATA CAPTURE
144
PROGRESS NOTES
146
ENCOUNTER DATA CAPTURE
149
PRACTICE GUIDELINE

FIG. 10

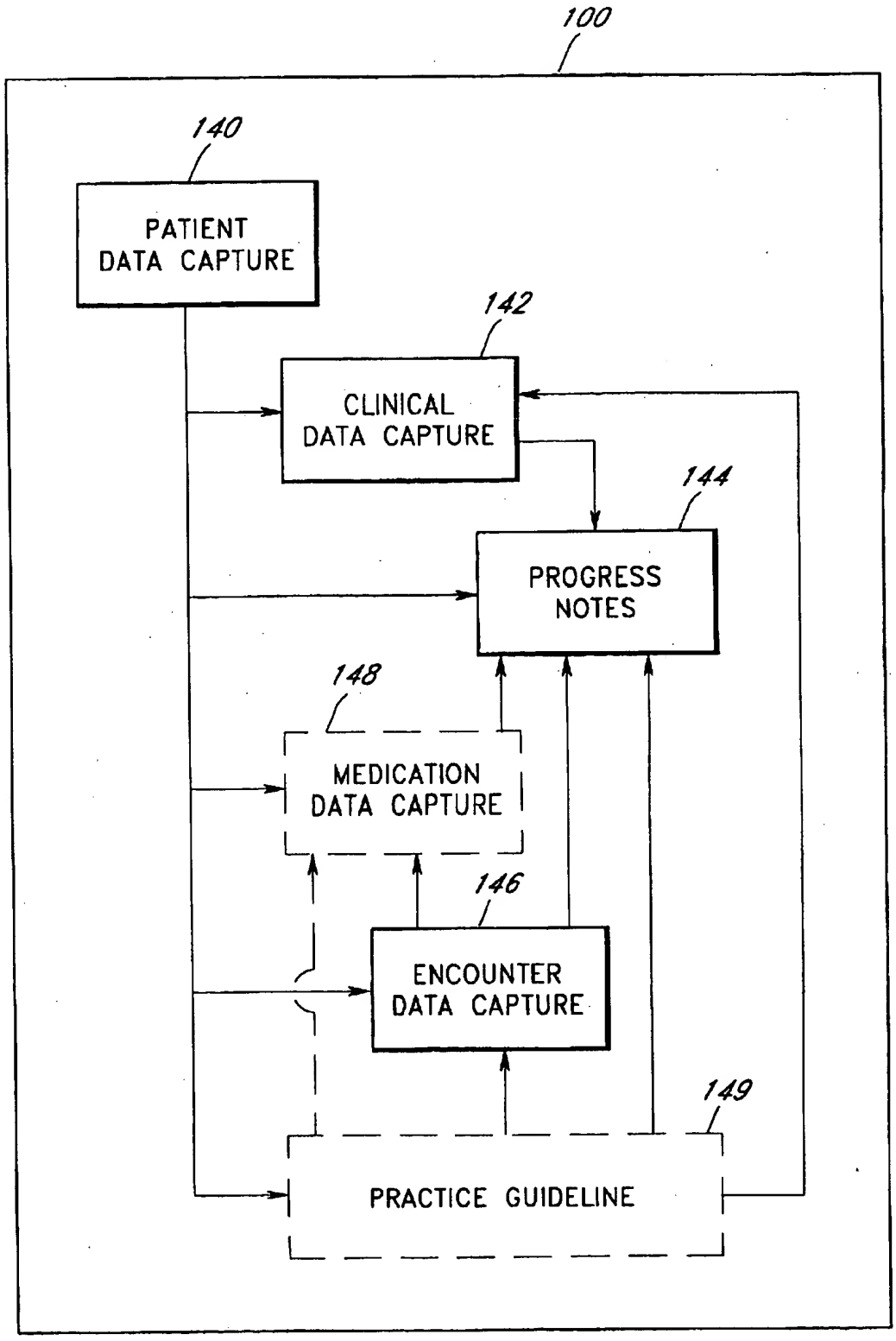

100
140
PATIENT DATA CAPTURE
142
CLINICAL DATA CAPTURE
144
PROGRESS NOTES
148
MEDICATION DATA CAPTURE
146
ENCOUNTER DATA CAPTURE
149
PRACTICE GUIDELINE

FIG. 11

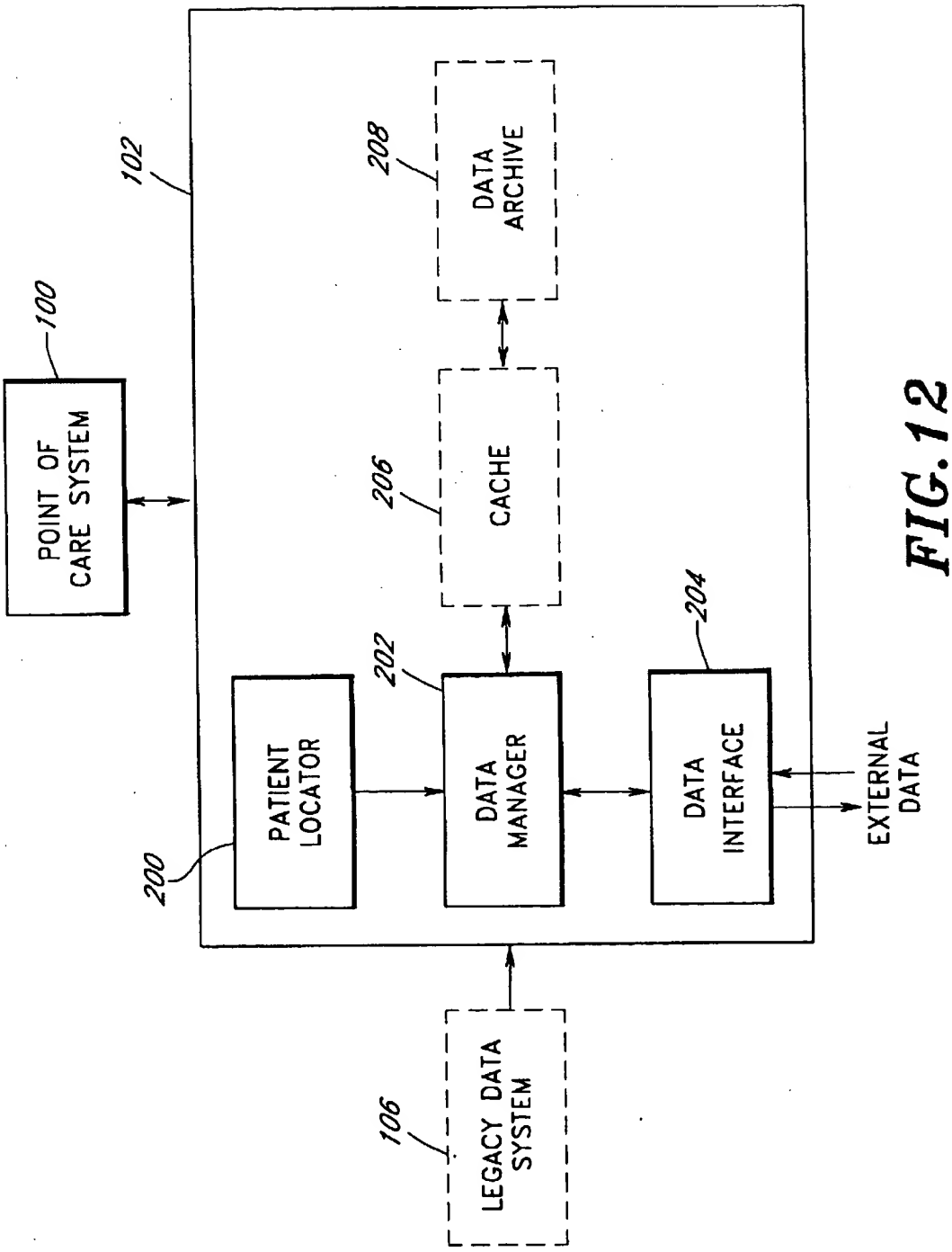

102
208
DATA ARCHIVE
100
POINT OF CARE SYSTEM
206
CACHE
204
202
PATIENT LOCATOR
DATA MANAGER
DATA INTERFACE
EXTERNAL DATA
200
106
LEGACY DATA SYSTEM

FIG. 12

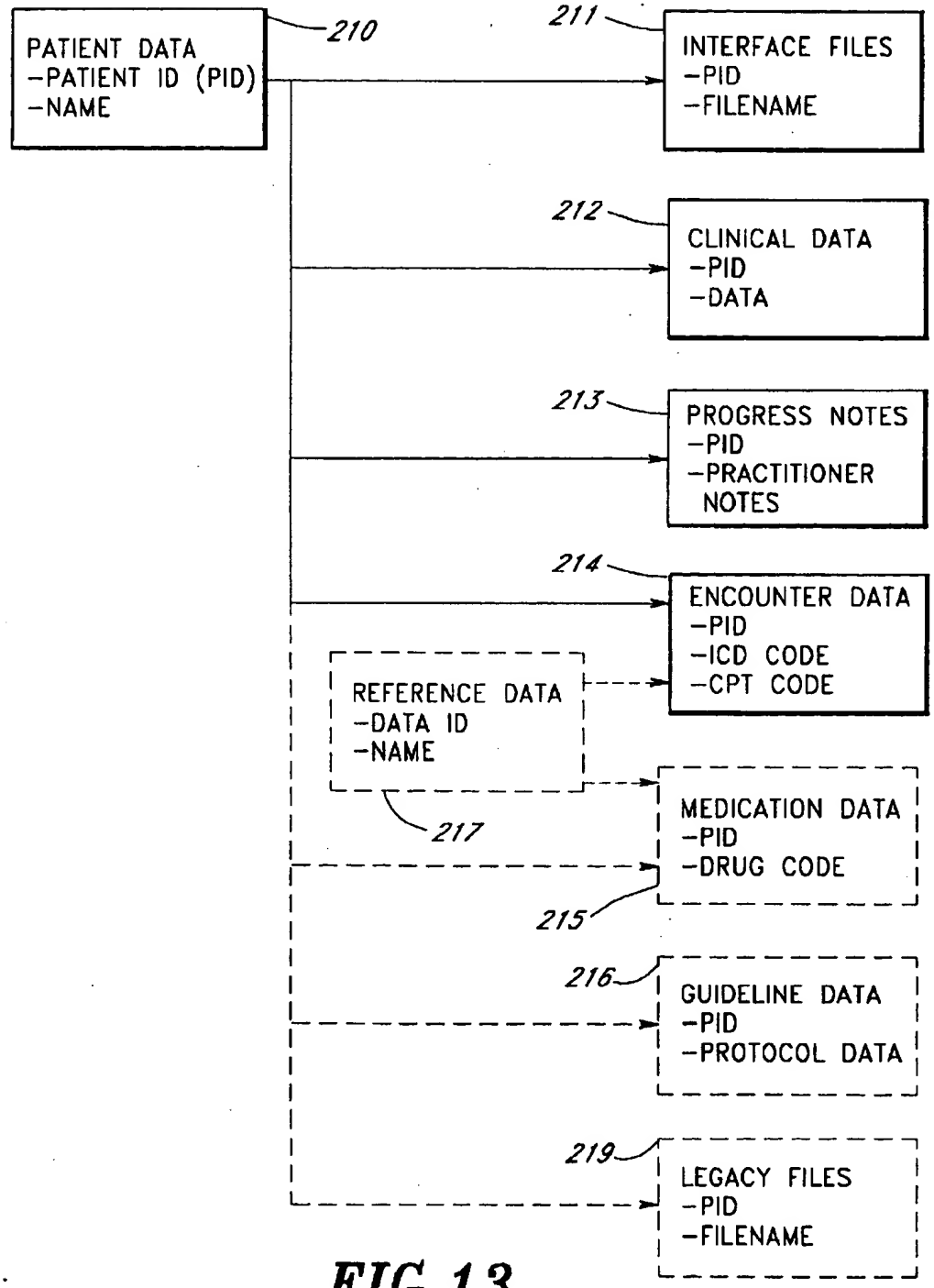

PATIENT DATA
-PATIENT ID (PID)
-NAME
210
211
INTERFACE FILES
-PID
-FILENAME
212
CLINICAL DATA
-PID
-DATA
213
PROGRESS NOTES
-PID
-PRACTITIONER NOTES
214
ENCOUNTER DATA
-PID
-ICD CODE
-CPT CODE
REFERENCE DATA
-DATA ID
-NAME
217
MEDICATION DATA
-PID
-DRUG CODE
215
216
GUIDELINE DATA
-PID
-PROTOCOL DATA
219
LEGACY FILES
-PID
-FILENAME

FIG. 13

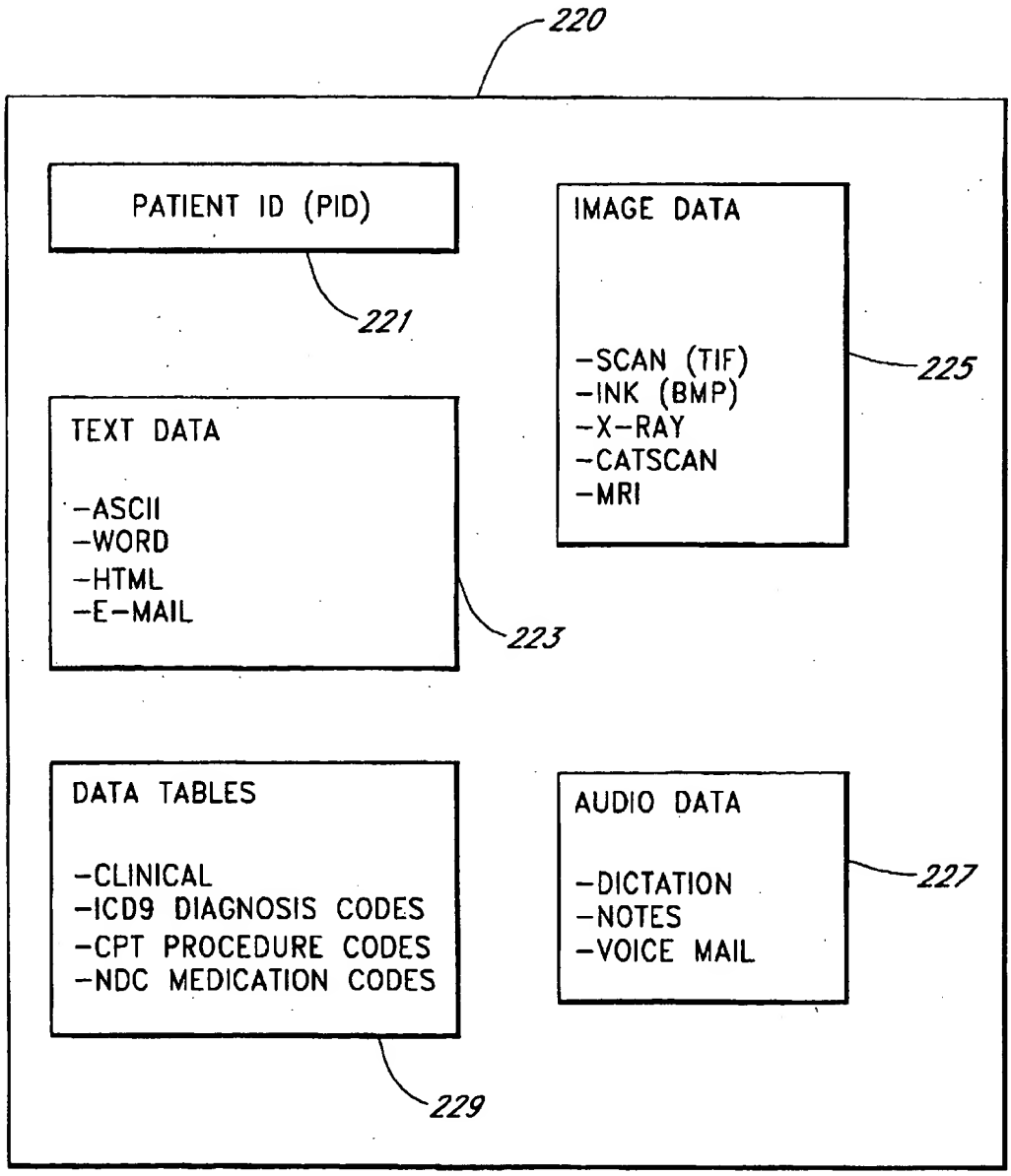

220
PATIENT ID (PID)
221
IMAGE DATA
-SCAN (TIF)
-INK (BMP)
-X-RAY
-CATSCAN
-MRI
225
TEXT DATA
-ASCII
-WORD
-HTML
-E-MAIL
223
DATA TABLES
-CLINICAL
-ICD9 DIAGNOSIS CODES
-CPT PROCEDURE CODES
-NDC MEDICATION CODES
229
AUDIO DATA
-DICTATION
-NOTES
-VOICE MAIL
227

FIG. 14

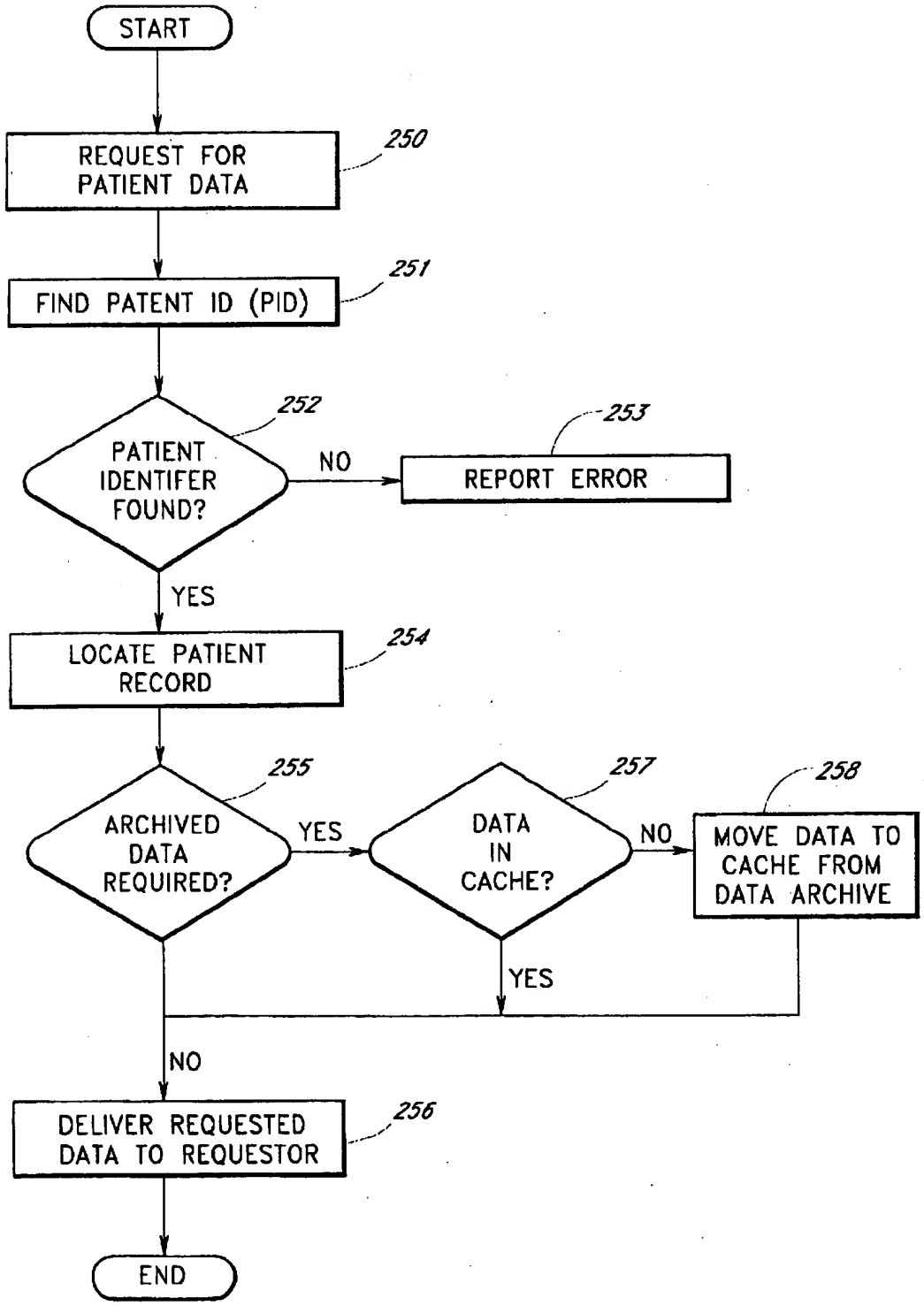

START
REQUEST FOR PATIENT DATA
250
FIND PATENT ID (PID)
251
PATIENT IDENTIFER FOUND?
252
NO
REPORT ERROR
253
YES
LOCATE PATIENT RECORD
254
ARCHIVED DATA REQUIRED?
255
YES
DATA IN CACHE?
257
NO
MOVE DATA TO CACHE FROM DATA ARCHIVE
258
YES
NO
DELIVER REQUESTED DATA TO REQUESTOR
256
END

FIG. 15A

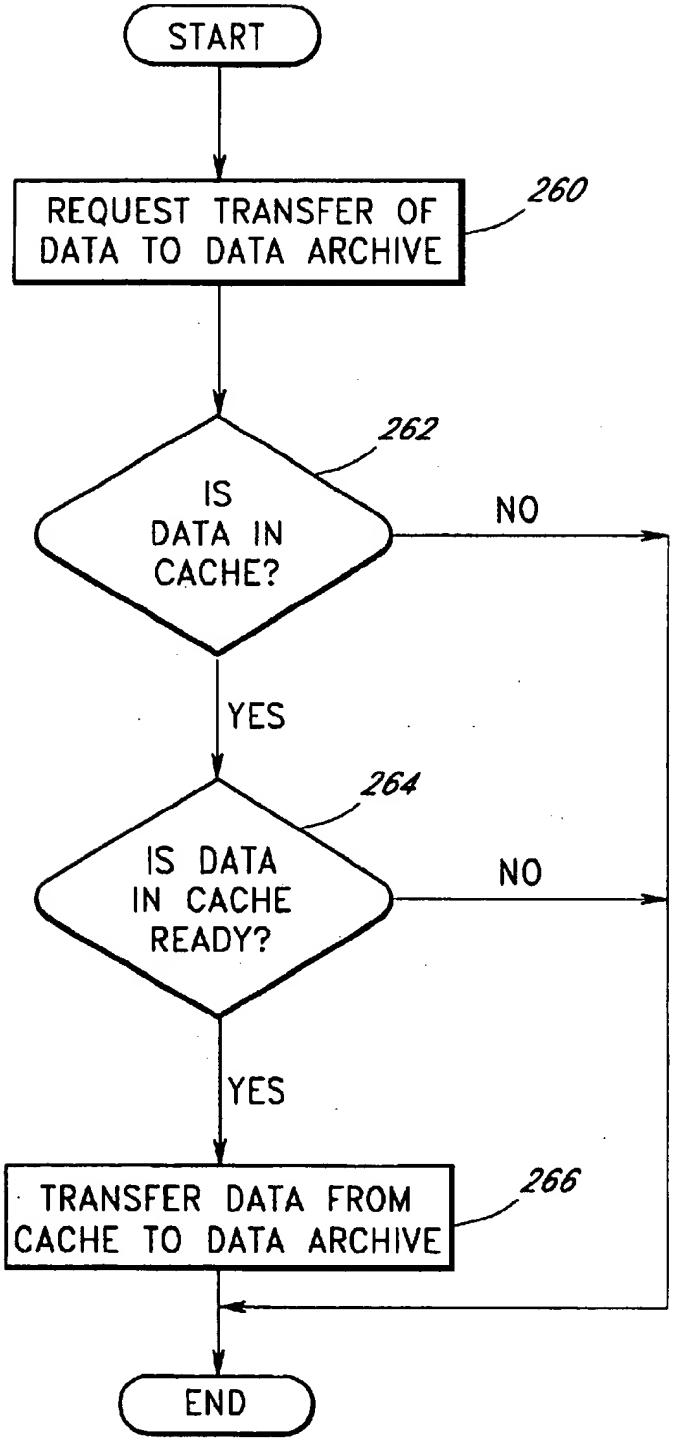

START
REQUEST TRANSFER OF DATA TO DATA ARCHIVE
260
IS DATA IN CACHE?
262
NO
YES
IS DATA IN CACHE READY?
264
NO
YES
TRANSFER DATA FROM CACHE TO DATA ARCHIVE
266
END

FIG. 15B

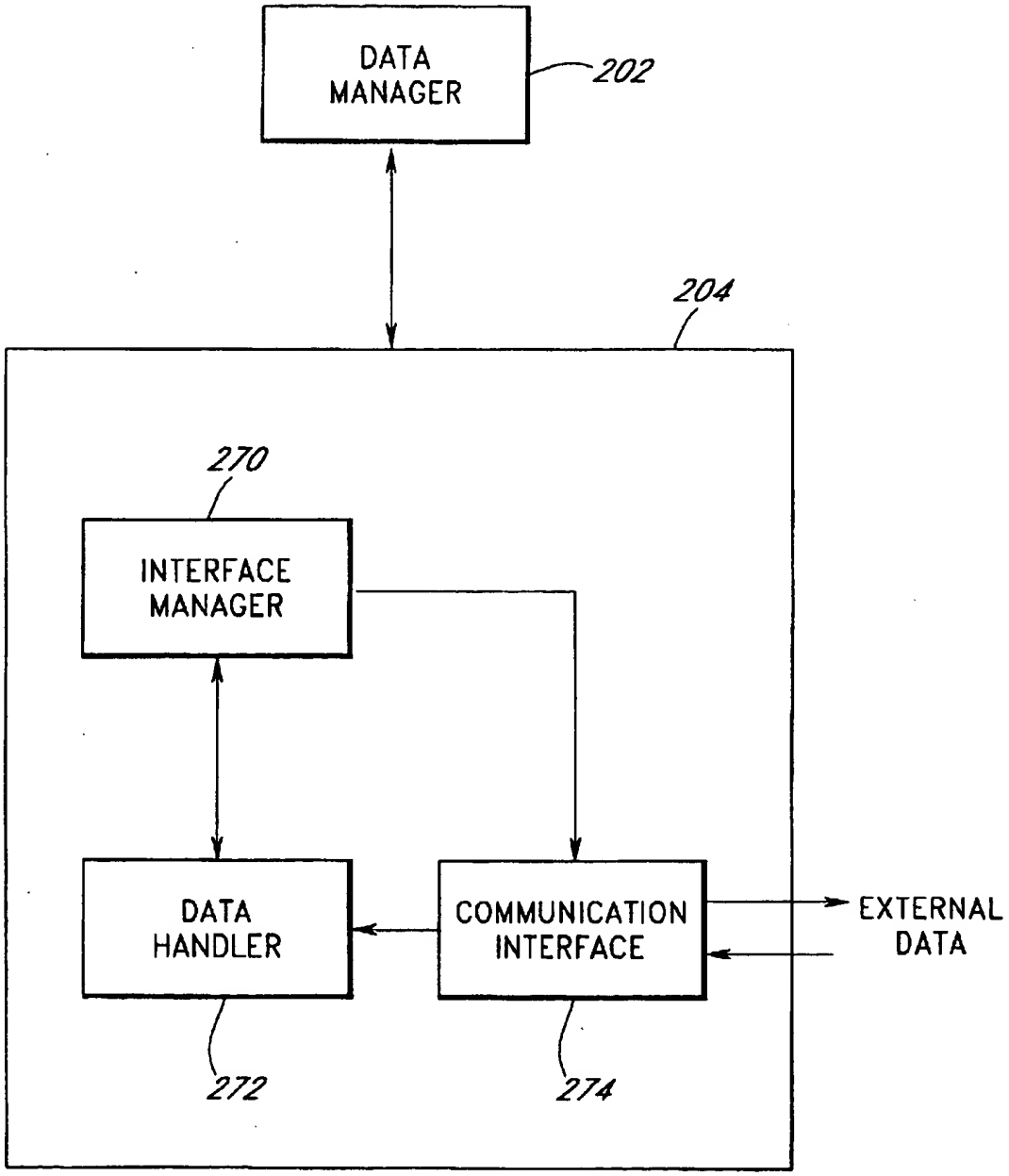

DATA MANAGER
202
204
270
INTERFACE MANAGER
DATA HANDLER
COMMUNICATION INTERFACE
EXTERNAL DATA
272
274

FIG. 16

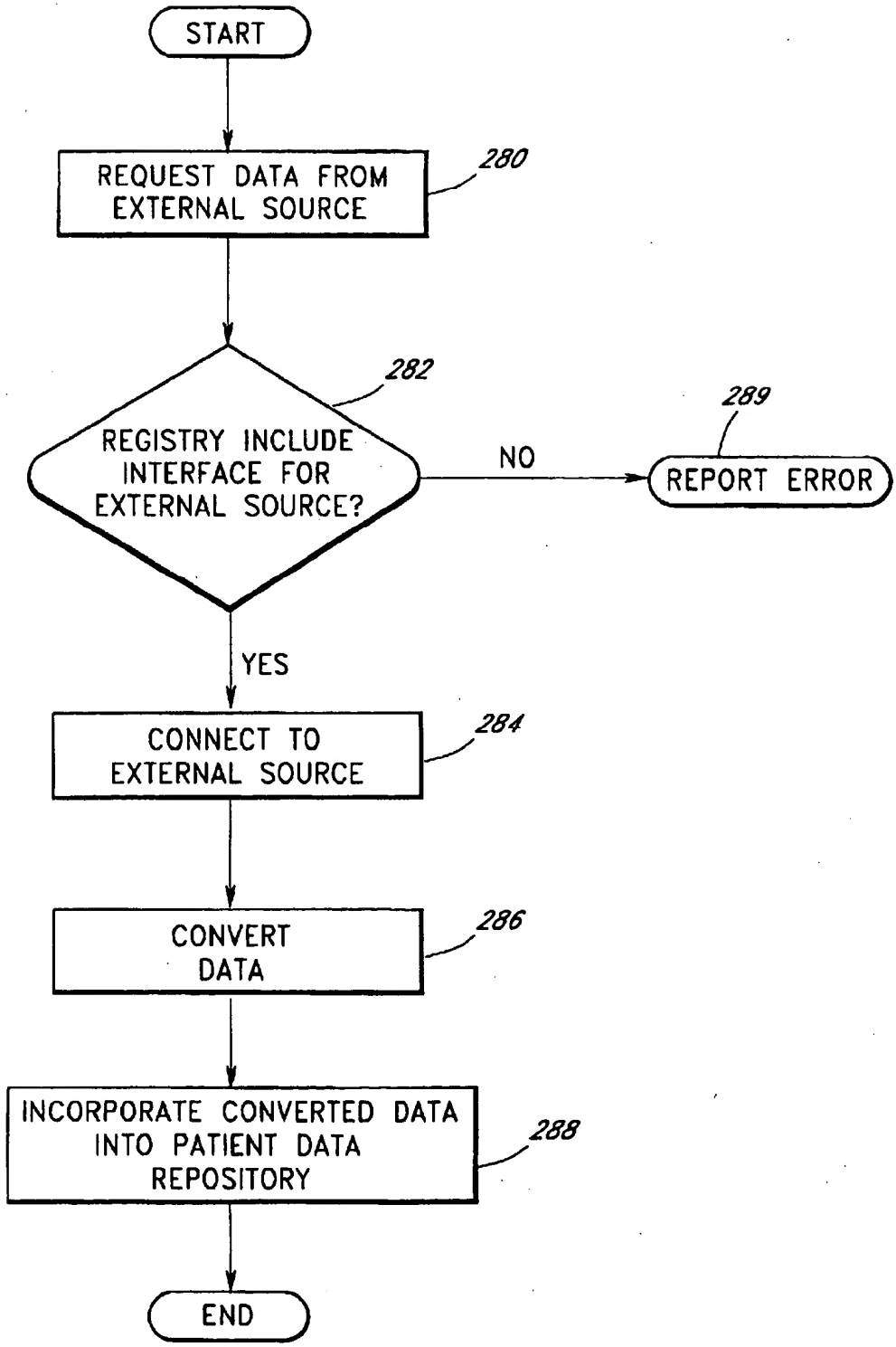

START
REQUEST DATA FROM EXTERNAL SOURCE
280
REGISTRY INCLUDE INTERFACE FOR EXTERNAL SOURCE?
282
NO
289
REPORT ERROR
YES
CONNECT TO EXTERNAL SOURCE
284
CONVERT DATA
286
INCORPORATE CONVERTED DATA INTO PATIENT DATA REPOSITORY
288
END

FIG. 17A

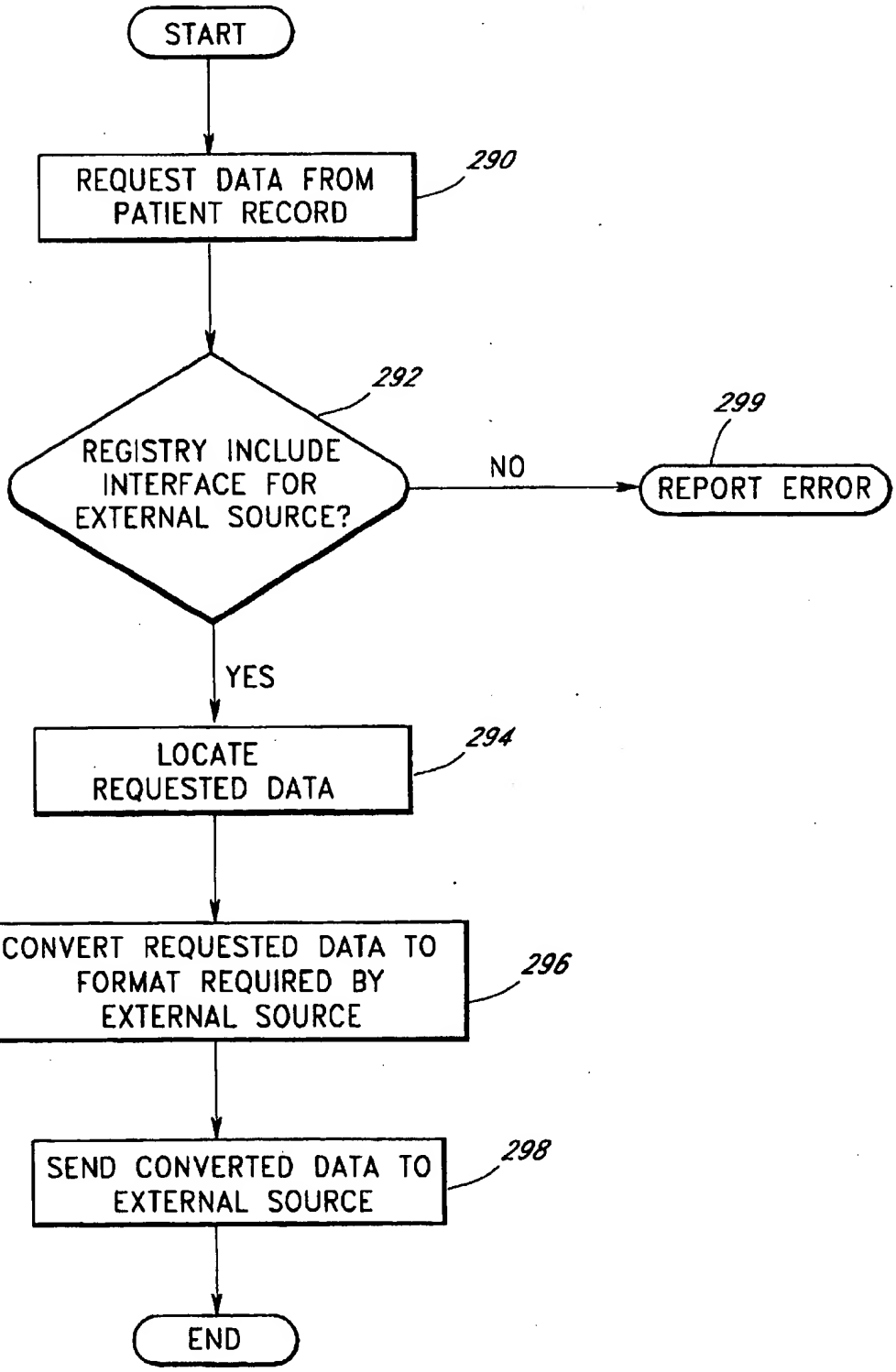

START
REQUEST DATA FROM PATIENT RECORD
290
REGISTRY INCLUDE INTERFACE FOR EXTERNAL SOURCE?
292
NO
299
REPORT ERROR
YES
LOCATE REQUESTED DATA
294
CONVERT REQUESTED DATA TO FORMAT REQUIRED BY EXTERNAL SOURCE
296
SEND CONVERTED DATA TO EXTERNAL SOURCE
298
END

FIG. 17B

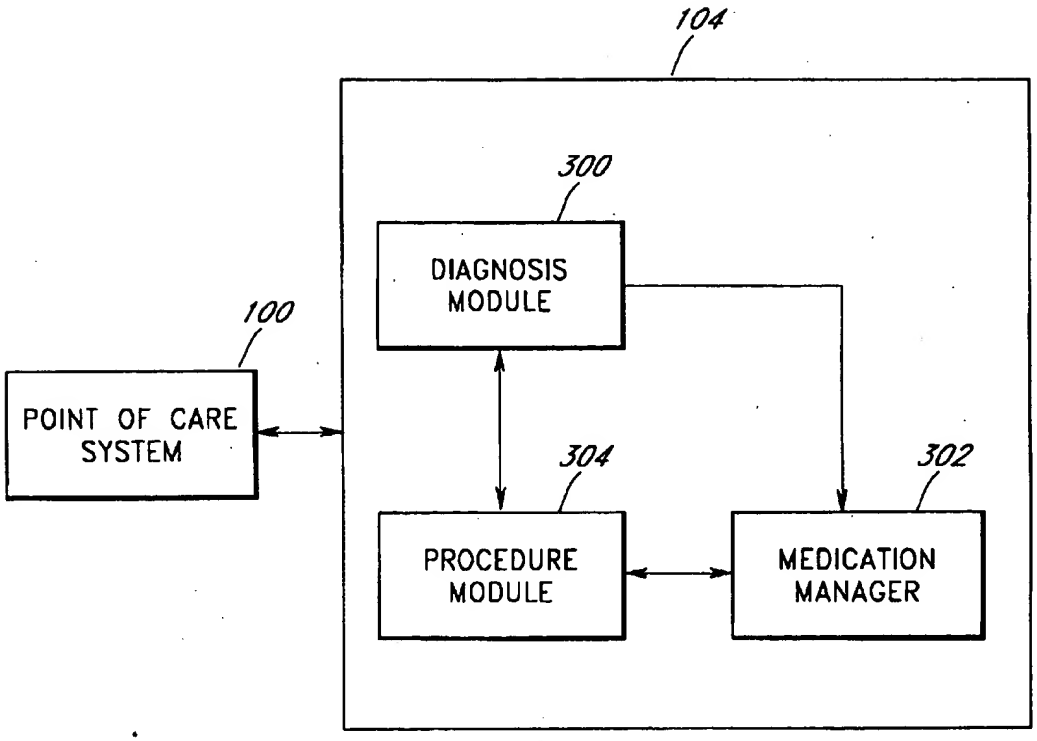

104
300
DIAGNOSIS MODULE
100
POINT OF CARE SYSTEM
304
302
PROCEDURE MODULE
MEDICATION MANAGER

FIG. 18

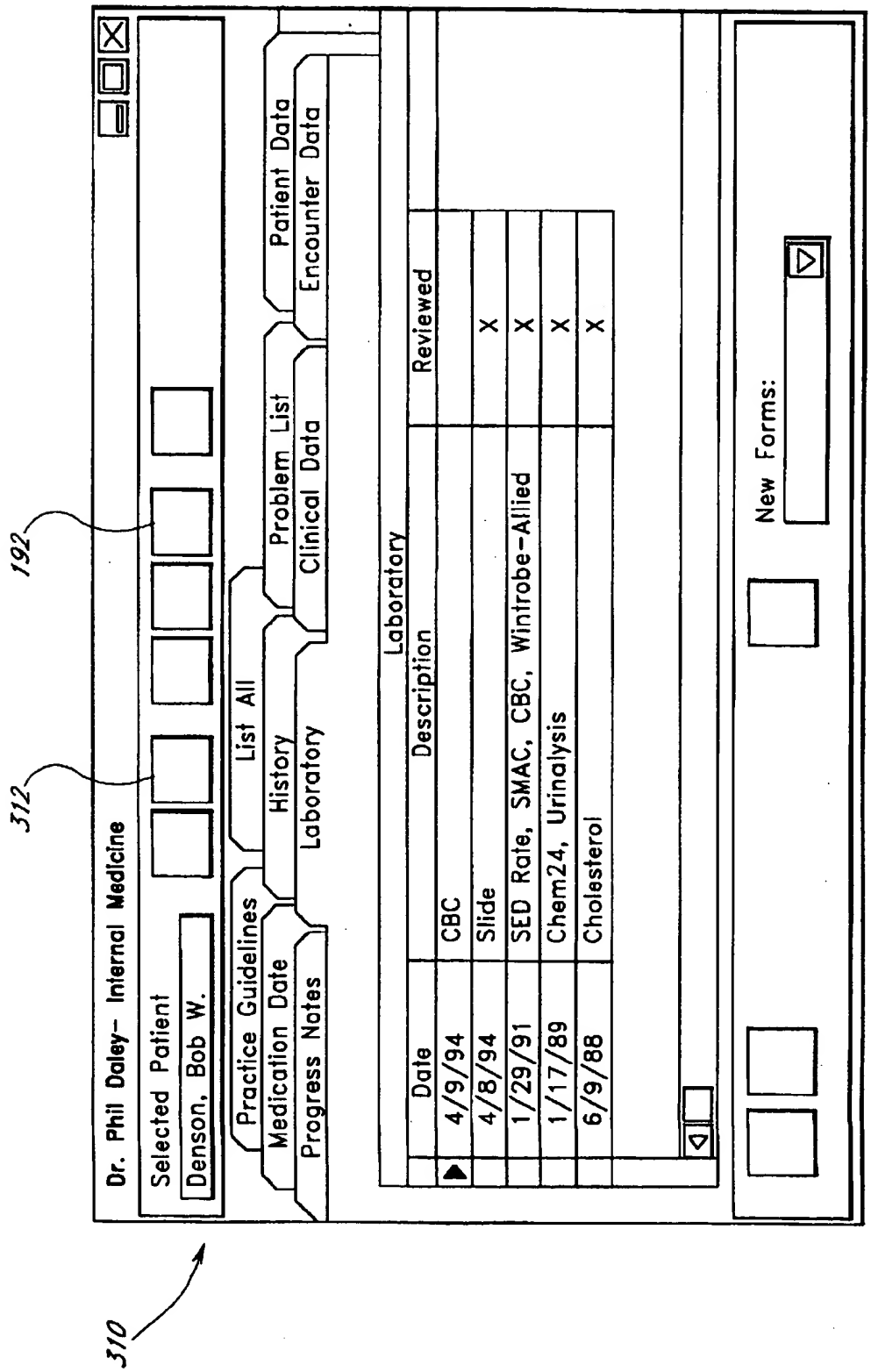

Dr. Phil Daley- Internal Medicine
Selected Patient
Denson, Bob W.
Practice Guidelines
Medication Date
Progress Notes
List All
History
Laboratory
Problem List
Clinical Data
Patient Data
Encounter Data
Laboratory
Date
Description
Reviewed
4/9/94
CBC
4/8/94
Slide
X
1/29/91
SED Rate, SMAC, CBC, Wintrobe-Allied
X
1/17/89
Chem24, Urinalysis
X
6/9/88
Cholesterol
X
New Forms:
192
312
310

FIG. 19

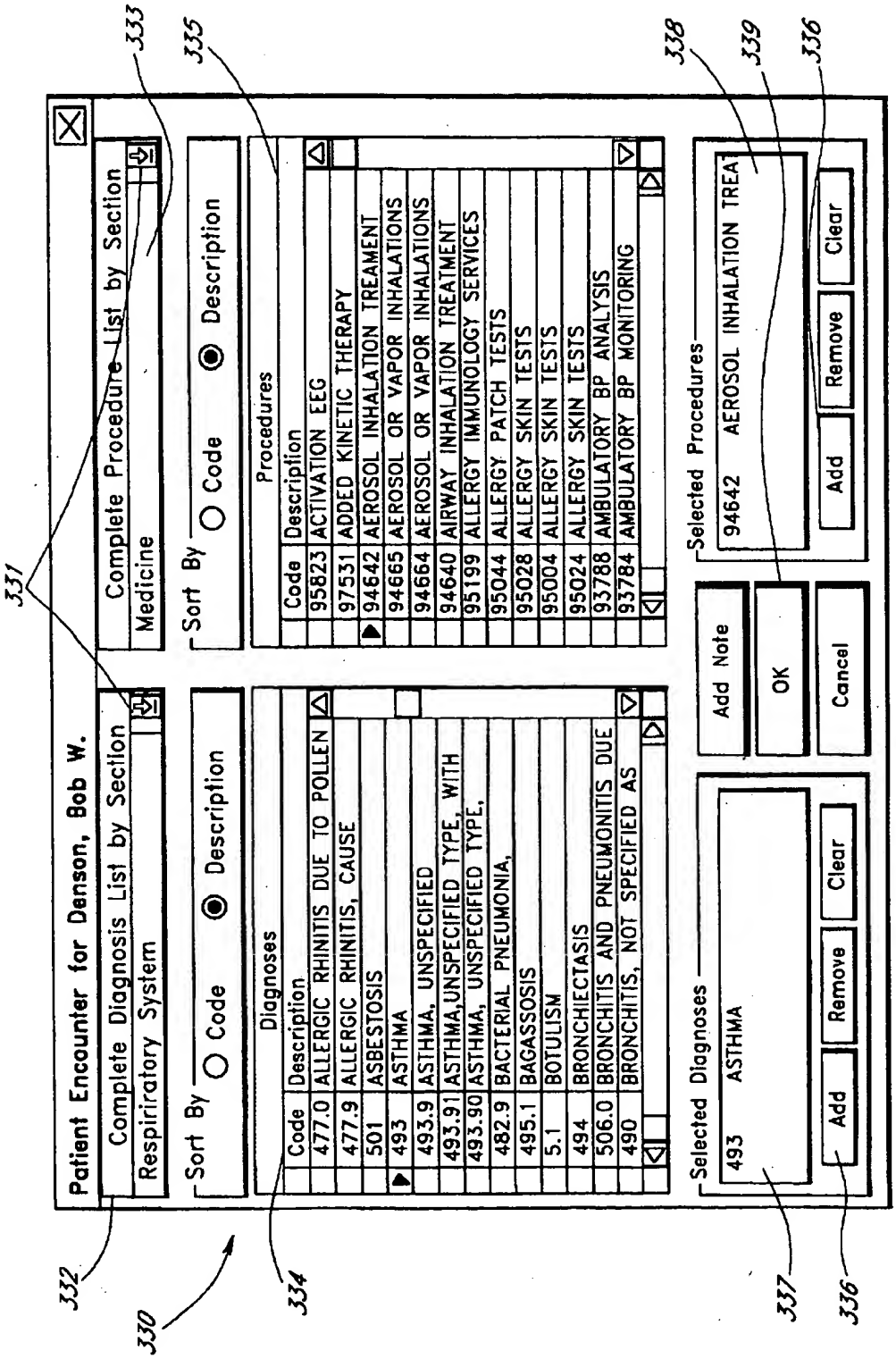

Patient Encounter for Danson, Bob W.
Complete Diagnosis List by Section
Respiriratory System
Sort By Code Description
Diagnoses
Code Description
477.0 ALLERGIC RHINITIS DUE TO POLLEN
477.9 ALLERGIC RHINITIS, CAUSE
501 ASBESTOSIS
493 ASTHMA
493.9 ASTHMA, UNSPECIFIED
493.91 ASTHMA,UNSPECIFIED TYPE, WITH
493.90 ASTHMA, UNSPECIFIED TYPE,
482.9 BACTERIAL PNEUMONIA,
495.1 BAGASSOSIS
5.1 BOTULISM
494 BRONCHIECTASIS
506.0 BRONCHITIS AND PNEUMONITIS DUE
490 BRONCHITIS, NOT SPECIFIED AS
Selected Diagnoses
493 ASTHMA
Add Remove Clear
Complete Procedure List by Section
Medicine
Sort By Code Description
Procedures
Code Description
95823 ACTIVATION EEG
97531 ADDED KINETIC THERAPY
94642 AEROSOL INHALATION TREAMENT
94665 AEROSOL OR VAPOR INHALATIONS
94664 AEROSOL OR VAPOR INHALATIONS
94640 AIRWAY INHALATION TREATMENT
95199 ALLERGY IMMUNOLOGY SERVICES
95044 ALLERGY PATCH TESTS
95028 ALLERGY SKIN TESTS
95004 ALLERGY SKIN TESTS
95024 ALLERGY SKIN TESTS
93788 AMBULATORY BP ANALYSIS
93784 AMBULATORY BP MONITORING
Add Note
OK
Cancel
Selected Procedures
94642 AEROSOL INHALATION TREA
Add Remove Clear
331
332
333
334
335
336
337
338
339
330

FIG.20

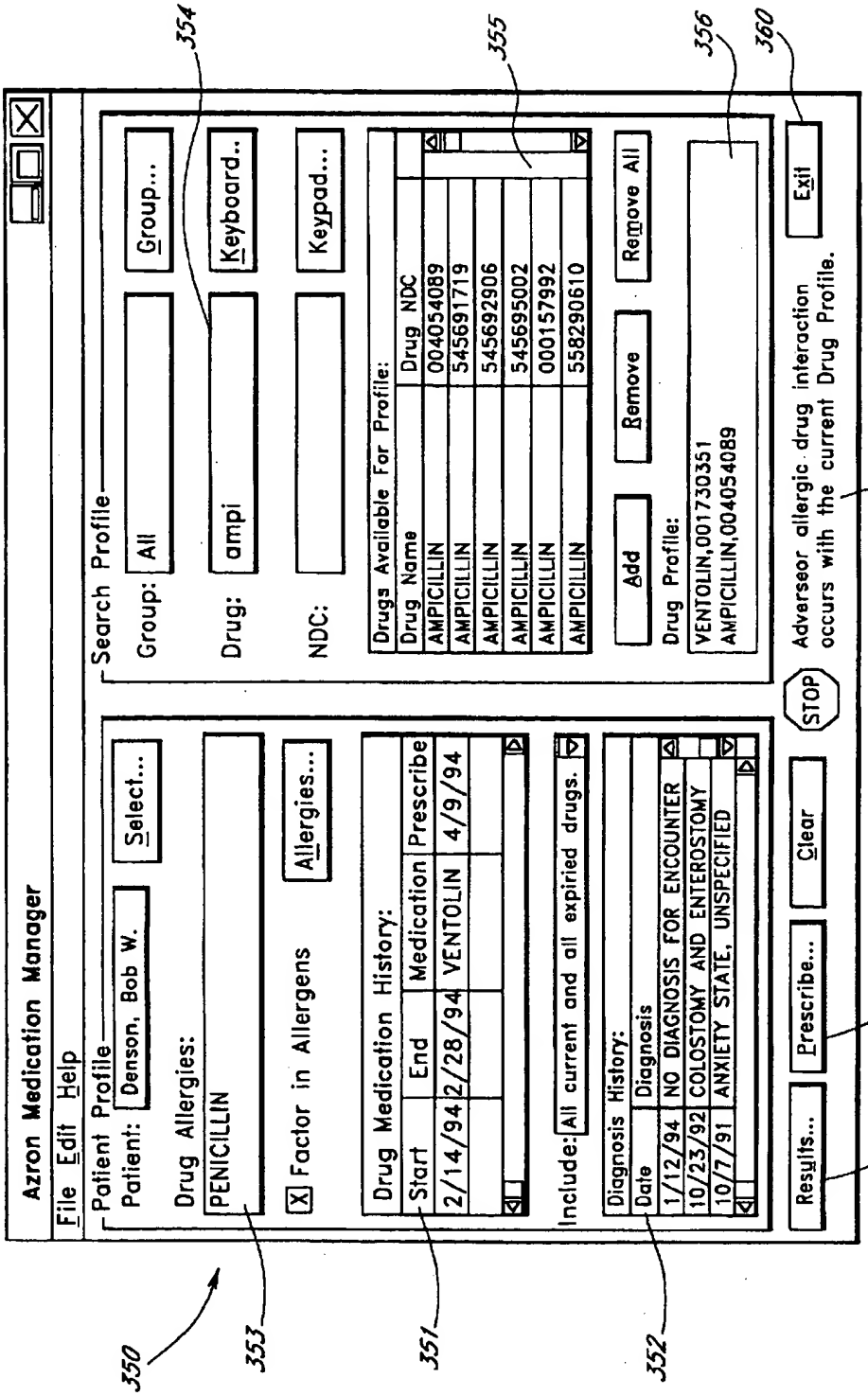

Azron Medication Manager
File Edit Help
Patient Profile
Patient: Denson, Bob W.
Select...
Drug Allergies:
PENICILLIN
X Factor in Allergens
Allergies...
Drug Medication History:
Start | End | Medication | Prescribe
2/14/94 | 2/28/94 | VENTOLIN | 4/9/94
Include: All current and all expiried drugs.
Diagnosis History:
Date | Diagnosis
1/12/94 | NO DIAGNOSIS FOR ENCOUNTER
10/23/92 | COLOSTOMY AND ENTEROSTOMY
10/7/91 | ANXIETY STATE, UNSPECIFIED
Results...
Prescribe...
Clear
STOP
Search Profile
Group: All
Group...
Drug: ampi
Keyboard..
NDC:
Keypad...
Drugs Available For Profile:
Drug Name | Drug NDC
AMPICILLIN | 004054089
AMPICILLIN | 545691719
AMPICILLIN | 545692906
AMPICILLIN | 545695002
AMPICILLIN | 000157992
AMPICILLIN | 558290610
Add
Remove
Remove All
Drug Profile:
VENTOLIN,001730351
AMPICILLIN,004054089
Adverseor allergic drug interaction occurs with the current Drug Profile.
Exit
350
353
351
352
354
355
356
357
358
359
360

FIG.21

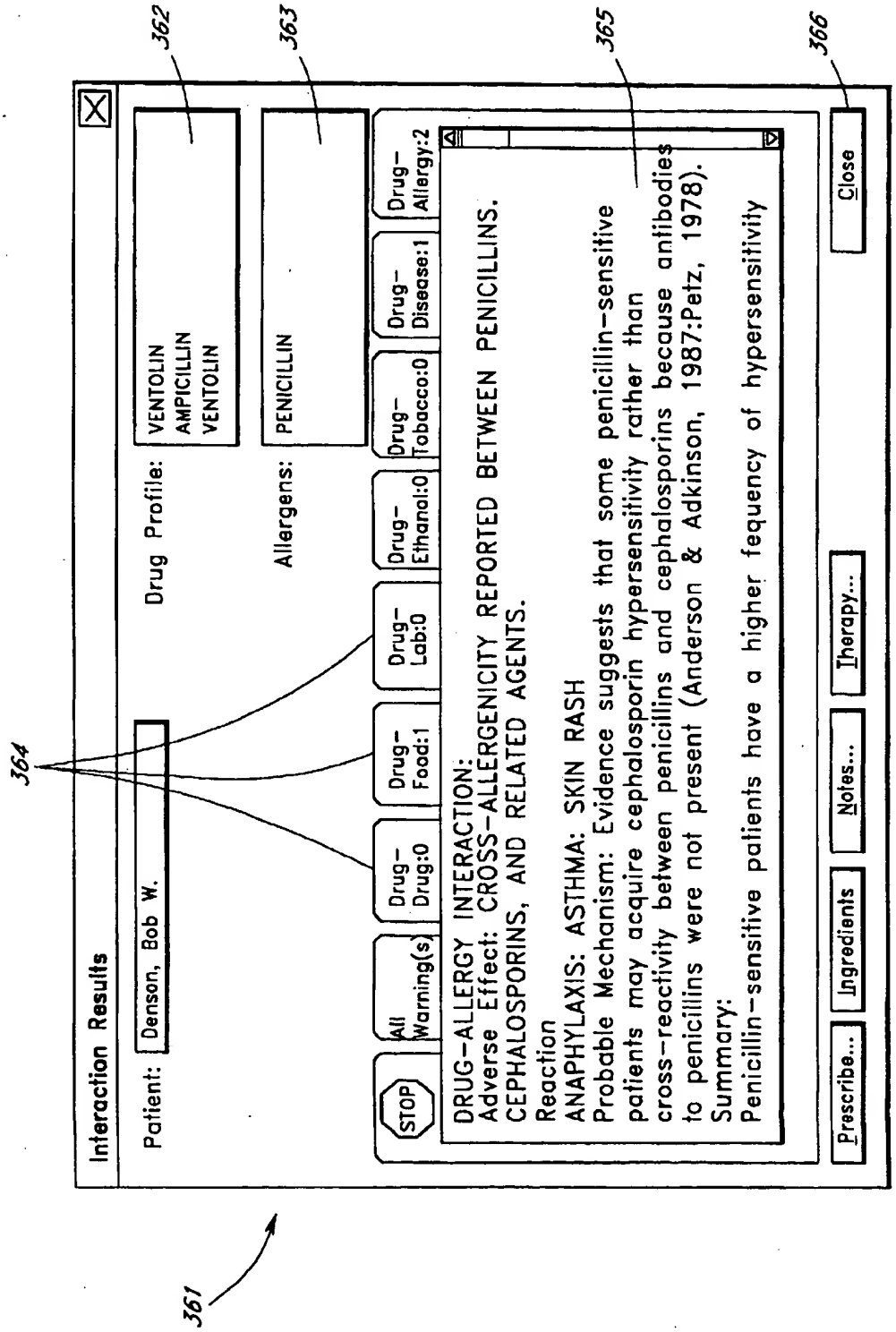

362
363
365
366
364
361
Interaction Results
Patient: Denson, Bob W.
Drug Profile:
VENTOLIN
AMPICILLIN
VENTOLIN
Allergens:
PENICILLIN
STOP
All Warning(s)
Drug-Drug:0
Drug-Food:1
Drug-Lab:0
Drug-Ethanol:0
Drug-Tobacco:0
Drug-Disease:1
Drug-Allergy:2
DRUG-ALLERGY INTERACTION:
Adverse Effect: CROSS-ALLERGENICITY REPORTED BETWEEN PENICILLINS, CEPHALOSPORINS, AND RELATED AGENTS.
Reaction
ANAPHYLAXIS: ASTHMA: SKIN RASH
Probable Mechanism: Evidence suggests that some penicillin-sensitive patients may acquire cephalosporin hypersensitivity rather than cross-reactivity between penicillins and cephalosporins because antibodies to penicillins were not present (Anderson & Adkinson, 1987:Petz, 1978).
Summary:
Penicillin-sensitive patients have a higher fequency of hypersensitivity
Prescribe...
Ingredients
Notes...
Therapy...
Close

FIG.22

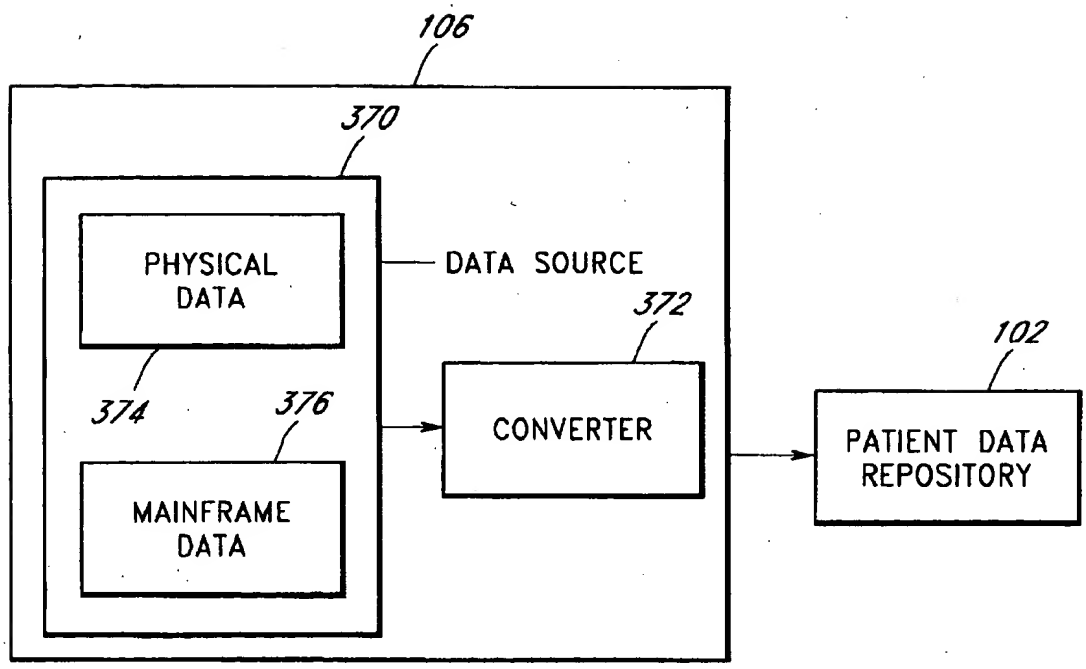

106
370
PHYSICAL DATA
DATA SOURCE
372
102
374
376
CONVERTER
PATIENT DATA REPOSITORY
MAINFRAME DATA

FIG. 23

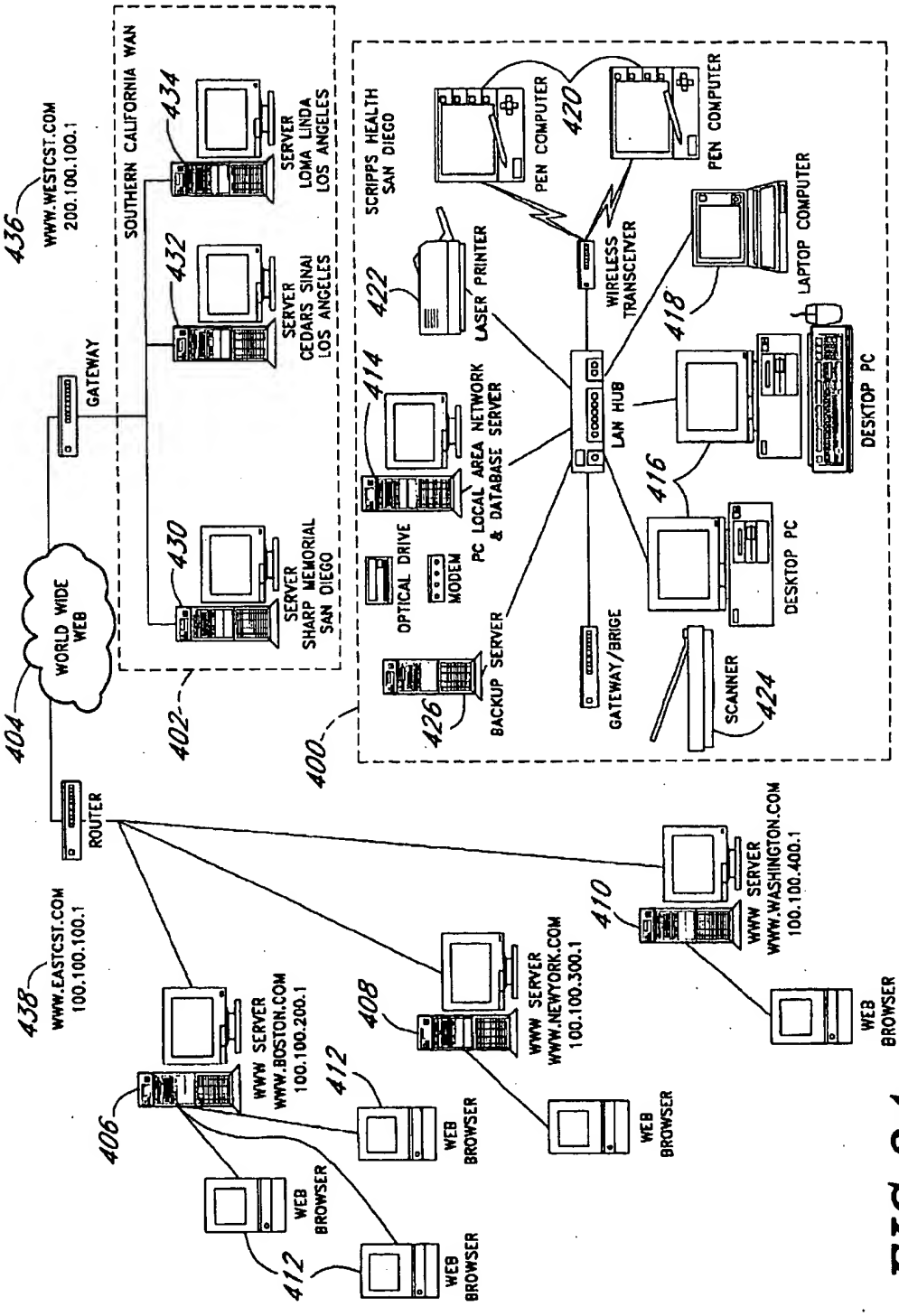

WWW.WESTCST.COM
200.100.100.1
436
SOUTHERN CALIFORNIA WAN
SERVER
LOMA LINDA
LOS ANGELES
434
SERVER
CEDARS SINAI
LOS ANGELES
432
SERVER
SHARP MEMORIAL
SAN DIEGO
430
GATEWAY
WORLD WIDE
WEB
404
402
400
SCRIPPS HEALTH
SAN DIEGO
PEN COMPUTER
420
PEN COMPUTER
WIRELESS
TRANSCEIVER
LASER PRINTER
422
LAPTOP COMPUTER
418
LOCAL AREA NETWORK
& DATABASE SERVER
414
LAN HUB
DESKTOP PC
OPTICAL DRIVE
MODEM
PC
416
DESKTOP PC
BACKUP SERVER
426
GATEWAY/BRIGE
SCANNER
424
ROUTER
WWW.EASTCST.COM
100.100.100.1
438
WWW SERVER
WWW.WASHINGTON.COM
100.100.400.1
410
WWW SERVER
WWW.BOSTON.COM
100.100.200.1
406
WWW SERVER
WWW.NEWYORK.COM
100.100.300.1
408
WEB
BROWSER
412
WEB
BROWSER
412
WEB
BROWSER
WEB
BROWSER
WEB
BROWSER

FIG.24

ELECTRONIC MEDICAL RECORDS SYSTEM

RELATED APPLICATIONS

This application is a continuation of U.S. application No. 09/333,170 filed on Jun. 14, 1999 which in turn is a cont. of U.S. application No. 08/721,182 filed on Sep. 27, 1996.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to electronic healthcare systems, and more particularly, to a system for storage and retrieval of electronic medical records in a computer environment, such as a local or wide area network including portable computers.

2. Description of Related Technology

Healthcare providers, such as physicians, create large volumes of patient information during the course of their business at healthcare facilities, such as hospitals, clinics, laboratories and medical offices. For example, when a patient visits a physician for the first time, the physician generally creates a patient file including the patient's medical history, current treatments, medications, insurance and other pertinent information. This file generally includes the results of patient visits, including laboratory test results, the physician's diagnosis, medications prescribed and treatments administered. During the course of the patient relationship, the physician supplements the file to update the patient's medical history. When the physician refers a patient for treatment, tests or consultation, the referred physician, hospital, clinic or laboratory typically creates and updates similar files for the patient. These files may also include the patient's billing, payment and scheduling records.

Healthcare providers can use electronic data processing to automate the creation, use and maintenance of their patient records. For example, in U.S. Pat. No. 5,277,188, assigned to New England Medical Center Hospitals, Inc., Selker discloses a clinical information reporting system having an electronic database including electrocardiograph related patient data. Similarly, Schneiderman discloses a computer system for recording electrocardiograph and/or chest x-ray test results for a database of patients in U.S. Pat. No. 5,099,424. In U.S. Pat. No. 4,315,309, Coli discloses a patient report generating system for receiving, storing and reporting medical test data for a patient population. Mitchell, in U.S. Pat. No. 3,872,448, likewise discloses a system for automatically handling and processing hospital data, such as patient information and pathological test information using a central processing apparatus. In U.S. Pat. No. 5,065,315, Garcia discloses a computerized scheduling and reporting system for managing information pertinent to a patient's stay in the hospital. However, these electronic data processing systems can not handle patient data in the wide variety of data formats typically produced by healthcare providers, such as physicians, laboratories, clinics and hospitals.

Physicians often use paper based forms and charts to document their observations and diagnosis. Laboratories also produce patient data in numerous forms, from x-ray and magnetic resonance images to blood test concentrations and electrocardiograph data. Clinics and hospitals may use a combination of paper based charts and electronic data for patient records. The same patient data may exist in remote patient files located at clinics, hospitals, laboratories and physicians' offices. Similarly, patient files at one healthcare provider typically have different information than patient files at another healthcare provider. When in use, patient files are generally not available to other healthcare providers. In addition, at the time of creation, patient data is generally not available for use by remotely located healthcare providers. Moreover, relationships among specific patient data, such as abnormal laboratory test results, prescribed medications to address the abnormality, and specific treatments administered by the physician, may not be apparent within a patient file.

In the current environment, specific patient data is difficult to access when needed for analysis. The creation of patient data in remote locations exacerbates this problem. In addition, the wide variety of data formats for patient data hinders electronic processing and maintenance of patient files. Moreover, the use of a patient's file by one healthcare provider can preclude its simultaneous use by another healthcare provider. Ongoing consolidation of healthcare providers into large health maintenance organizations (HMOs) and preferred provider organizations (PPOs) create issues in the transfer and maintenance of patient data in large enterprises having numerous remote locations. Under these circumstances, healthcare providers have difficulty providing effective treatment for their patients.

SUMMARY OF THE INVENTION

The electronic medical record (EMR) system of the present invention automates and simplifies existing methods of patient chart creation, maintenance and retrieval. In contrast to other systems, the present invention creates and maintains all patient data electronically and thus can eliminate or supplement creating and maintaining of physical data records. The EMR system furnishes healthcare providers with an intuitive, easy-to-use, icon-based interface that enables them to capture and analyze patient data quickly and efficiently. Using the present invention, healthcare providers enter patient data immediately at the point of care. Thus, the EMR system captures each piece of data at its source at the time of entry to provide a complete audit trail for all patient data. In this manner, the EMR system transforms a patient chart from a static record of a few clinical interactions into a dynamic, real-time comprehensive record linked to an enterprise-wide clinical database. In addition, the EMR system of the present invention includes the capability to manage a wide variety of patient data formats, including patient data from external sources, such as laboratories and pharmacies. The EMR system can also incorporate a patient's legacy data, such as a paper chart, into the patient record as well as legacy data from mainframe computers.

The present invention likewise provides instant access to a patient's electronic medical record by authorized healthcare providers from any geographical location. Thus, the EMR system enables authorized healthcare providers to access and update patient files using wireless pen-based personal computers. To enable complete replacement of physical records, the present invention permits healthcare providers, such as physicians or nurse practitioners, to electronically annotate patient data. Thus, a healthcare provider can acknowledge reviewing patient data, provide instructions, such as prescriptions for medication to administer to a patient, and approve recommendations for treatment by other providers, all by electronically annotating a patient's record. In addition, authorized healthcare providers can access a record while other providers use the same record allowing for real-time collaboration. The availability of electronic data permits instant, sophisticated analysis of patient data. Moreover, the EMR system enables enhanced

analysis of patient data by providing access to reference databases for diagnosis, procedures and medication.

One aspect of the present invention includes a medical records system, comprising a point of care system to capture patient data at a point of care and a patient data repository, in communication with the point of care system and with external systems, to store and organize the patient data for access by the point of care system.

Another aspect of the present invention includes a medical records system comprising a point of care system to capture data in a patient record at a point of care, wherein the patient record includes a patient identifier and at least one data structure including the patient identifier and the data.

Yet another aspect of the present invention includes a medical records system comprising a point of care system to capture data at a point of care and a patient data repository, in communication with the point of care system and with external systems to store and organize the data in a patient record for access by the point of care system, wherein the patient record includes a patient identifier and at least one data structure including the patient identifier and the data.

In addition, another aspect of the present invention includes a method of using an electronic medical records system, comprising the steps of capturing patient data electronically at the point of care, organizing the patient data so as to form a patient record, filing the patient record, and retrieving the patient record to access the patient data for use in the care of a patient.

Yet another aspect of the present invention includes a method of retrieving patient data in an electronic medical records system having a patient data repository, comprising the steps of obtaining a patient identifier, locating a patient record corresponding to the patient identifier in the patient data repository, and determining the location of the patient data within the patient record.

Another aspect of the present invention includes a method of managing a patient data repository having a cache and a data archive, comprising the steps of monitoring a status of data within the cache, and moving the data to the data archive when the status exceeds a threshold.

Still another aspect of the present invention includes a method of communicating with an external source having an interface to an electronic medical records system, comprising the steps of finding an interface for the external source, connecting to the external source using the interface, and converting patient data for transfer between the external source and the electronic medical records system.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram illustrating the electronic medical record (EMR) system architecture of the present invention.

FIG. **2** is a flowchart illustrating the process flow of the EMR system of the present invention.

FIG. **3** shows an example of a graphical user interface of the EMR system useful for the scheduling of a patient appointment as shown in FIG. **2**.

FIG. **4** is a block diagram illustrating the structure of the point of care system of FIG. **1**.

FIG. **5** shows an example of a graphical user interface of the point of care system of FIG. **4**.

FIG. **6** shows an example of a new form window of the point of care system of FIG. **4**.

FIG. **7** shows an example of an annotate window of the point of care system of FIG. **4**.

FIG. **8** shows an example of a viewer window displaying an image of patient data of the point of care system of FIG. **4**.

FIG. **9** is a block diagram illustrating the structure of a medication data capture in the point of care system of FIG. **4**.

FIG. **10** is a block diagram illustrating the structure of a practice guideline in the point of care system of FIG. **4**.

FIG. **11** is a block diagram illustrating the structure of the medication data capture and the practice guideline in the point of care system of FIG. **4**.

FIG. **12** is a block diagram illustrating the structure of the patient data repository of FIG. **1**.

FIG. **13** is a block diagram illustrating the structure of a patient record within the patient data repository of FIG. **12**.

FIG. **14** is an example of the patient record of FIG. **13**.

FIG. **15***a* is a flowchart illustrating the process flow of the patient data repository of FIG. **12**.

FIG. **15***b* is a flowchart illustrating the process for a transfer of data from a cache to a data archive in the patient data repository of FIG. **12**.

FIG. **16** is a block diagram illustrating the structure of the data interface of FIG. **12**.

FIG. **17***a* is a flowchart illustrating the process flow of the data interface of FIG. **16** when receiving patient data from an external source.

FIG. **17***b* is a flowchart illustrating the process flow of the data interface of FIG. **16** when transmitting patient data to an external source.

FIG. **18** is a block diagram illustrating the structure of the reference database of FIG. **1**.

FIG. **19** shows an example of a graphical user interface of the point of care system of FIG. **4** having a reference access button and a medication manager button.

FIG. **20** shows an example of a graphical user interface for the diagnosis module and the procedure module of the reference database of FIG. **18**.

FIG. **21** shows an example of a graphical user interface for the medication manager of the reference database of FIG. **18**.

FIG. **22** shows an example of a medication interaction window of the medication manager of FIG. **21**.

FIG. **23** is a block diagram illustrating the structure of the legacy data system of FIG. **1**.

FIG. **24** is an example of a typical configuration for the electronic medical records system of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The following detailed description of the preferred embodiments presents a description of certain specific embodiments to assist in understanding the claims. However, one may practice the present invention in a multitude of different embodiments as defined and covered by the claims.

For convenience, the description comprises three sections: EMR System Architecture and Overview, EMR System Configurations and Summary. The first section provides an overview of the EMR system architecture, the following section describes EMR system applications and preferred embodiments for practicing the EMR system of the present invention, and the remaining section summarizes advantageous features of the present invention.

I. EMR System Architecture and Overview

FIG. 1 illustrates the architecture of the EMR system. Healthcare providers, such as physicians, at hospitals, laboratories and clinics, generally capture and access patient data using a point of care system **100** that communicates with a patient data repository **102**. Patient data, such as vital signs, x-ray images and laboratory results, resides in the patient data repository **102**. The patient data repository **102** also communicates with external sources to obtain patient data, such as laboratory test results and x-ray images, and to transfer patient information, such as prescriptions for medication, from the EMR system to other healthcare providers. The point of care system **100** captures patient data in realtime at the point of care, that is, where healthcare providers interact with their patients. For example, physicians can use a point of care system **100** to enter, access, process, analyze and annotate data from patient records in real-time at the point of care. Thus, using the point of care system **100**, a physician, who has many patients in a hospital, can visit each patient in their room, access their electronic patient record there, enter results of the current examination, evaluate their medical history, electronically annotate their x-rays images and prescribe medications and treatments instantaneously as the point of care system **100** captures and organizes patient data into the patient record stored in the patient data repository **102**. The point of care system **100** may likewise communicate with a reference database **104** to assist a healthcare provider in making diagnoses, prescribing medications and administering treatments. Moreover, the patient data repository **102** may also communicate with a legacy data system **106** to access pertinent patient data in paper files and mainframe electronic databases.

Referring now to FIG. **2**, a flowchart illustrates the operation of the EMR system. For example, a patient having a complaint contacts a healthcare provider **110**, such as a physician, to schedule an appointment. The EMR system obtains the patient record **111** from the patient data repository **102** (FIG. **1**) prior to the scheduled appointment. The EMR system is also capable of handling patients on a walk-in basis by scheduling an appointment and requesting the patient's record immediately thereafter. The EMR system updates the patient record **112** to include the complaint and other information pertinent to the appointment, such as insurance information. A healthcare provider, such as a physician, examines the patient **113** using the point of care system **100** (FIG. **1**) to make a diagnosis and to treat the patient's condition. As determined at **114**, if a diagnosis is not possible on the basis of this examination, the physician may need to obtain additional clinical data **115**, such as laboratory tests and x-rays. When available, the physician uses the point of care system **100** (FIG. **1**) to evaluate the results **116** and to examine the patient **113** again in light of the results. Upon making a diagnosis, the physician may need to prescribe medications **117** for the patient's condition. Similarly, the physician may need to administer a treatment **118** to address the patient's condition. At the conclusion of the patient's visit, the EMR system files the patient's record **119** in the patient data repository **102** (FIG. **1**) for future reference.

In a preferred embodiment, the EMR system includes graphical user interfaces to access system functions. For example, as shown in FIG. **3**, a chart puller window **120** enables a healthcare provider to schedule a patient appointment using its point and click interface. To schedule an appointment, a healthcare provider activates the select button **121** with a pointing device, such as a mouse or electronic pen, to obtain a list of patients. The healthcare provider then scans the list to select the name of the appropriate patient using a pointing device. The EMR system places the name of the selected patient in the patient box **123**. Similarly, the healthcare provider uses the up/down buttons **125** to select an appointment date and an appointment time. An adjacent box, such as the date box **126**, displays the selected date and time. Lastly, the healthcare provider enters a textual description of the patient's complaint in a reason box **127**. Note that the healthcare provider can review prior or future scheduled appointments by clicking on the appointments button **128**. Similarly, the healthcare provider can track referrals by entering the identity of persons who referred this patient to their care in the referral box **129**.

Referring now to FIG. **4**, a block diagram illustrates the structure of the point of care system **100**. The point of care system **100** includes the following modules: a patient data capture **140**, a clinical data capture **142**, progress notes **144** and an encounter data capture **146**. During a patient visit, the healthcare provider (not shown) can enter, review and annotate patient information, such as family history, appointments, current medications and complaints, using the patient data capture **140**. The healthcare provider can likewise enter, review and annotate clinical data obtained during the visit, such as body temperature and blood pressure, using the clinical data capture **142**. Similarly, the healthcare provider can enter laboratory data for patients with the clinical data capture **142**. The clinical data capture **142** communicates with the patient data capture **140** to assist in identifying needs for further clinical data. For example, a family history of high blood pressure may indicate a need to obtain the patient's blood pressure during the visit. The patient data capture **140** also communicates with the encounter data capture **146**, where a healthcare provider can enter, review and annotate data regarding diagnoses and procedures administered to the patient. Moreover, the healthcare provider can use the progress notes **144** to summarize details of the patient's condition and to review the patient's progress over time. Thus, the progress notes **144** communicates with the patient data capture **140**, the clinical data capture **142** and the encounter data capture **146**.

Referring now to FIG. **5**, in a preferred embodiment, the point of care system **100** (FIG. **1**) includes a graphical user interface having a patient chart window **150** to capture patient information. The point of care system **100** presents a patient record graphically using a tabbed layout to organize patient data. The patient chart window **150** includes tabs for patient data **151**, clinical data **152**, encounter data **153** and progress notes **154**. Pointing and clicking on a tab on the patient chart window **150** opens a folder window **155** where a healthcare provider can enter and review patient data within the folder. For example, to activate progress notes **144** (FIG. **4**), the healthcare provider selects the progress notes tab **154** to display a list of progress note data in the folder window **155**. In a similar manner, to activate the patient data capture **140**, the clinical data capture **142** or the encounter data capture **146**, one selects the patient data tab **151**, the clinical data tab **142**, or the encounter data tab **153**, respectively.

To enter patient data, the healthcare provider clicks on the scroll down button **156** to select a form from a list of available forms to enter patient data. This activates the new forms box **157**. The provider then points and clicks on the new form button **158**. For example, FIG. **6** shows a new form window **161** displaying the pediatric problem form **162** selected by the healthcare provider using the scroll down button **156** (FIG. **5**). The healthcare provider fills out the

pediatric problem form **162** using an input device, such as a keyboard, a mouse or an electronic pen. For example, the provider uses a keyboard to enter text "Jun. 7, 1996 Stomach Ache" **164** and an electronic pen to enter initials **166** for identification. When done with patient data entry, the provider exits the form using the File Menu **168** and the point of care system **100** returns the provider to the patient chart window **150** (FIG. **5**). Referring back to FIG. **5**, the new form appears as the top entry of the list in the folder window **155**.

Similarly, to annotate patient data, the healthcare provider first selects an item to annotate by pointing and clicking on the item in a list displayed in the folder window **155**. The provider then clicks on the annotate button **159** to open the item in an annotate window **170**, as shown in FIG. **7**. For example, the annotate window **170** of FIG. **7** displays a blood test result **172**. As before, the healthcare provider annotates the blood test result document **172** using an input device, such as a keyboard, a mouse or an electronic pen. For example, the provider uses a keyboard to enter text "Out of Range" **174** and an electronic pen to circle **176** the out of range result. When done with annotations, the provider exits the form using the File Menu **178** and the point of care system **100** returns the provider to the patient chart window **150** (FIG. **5**). Note that the point of care system **100** tracks the review of patient data and identifies reviewed files with a mark **160** in the folder window **155**. By annotating patient data, a healthcare provider, such as a physician, can acknowledge reviewing patient data, provide instructions, such as directions for additional tests and procedures or prescriptions for medication to administer to the patient, and approve recommendations for treatment by other healthcare providers. Lastly, as shown in FIG. **8**, a healthcare provider uses the patient chart window **180** to view patient data. First, the healthcare provider selects a view item **182** by either pointing and clicking twice on the item in a list displayed in the folder window **184** or by pointing at the item in the list and pressing the view button **183**. The double click opens a viewer window **185** to display the view item **182**. For example, the viewer window **185** of FIG. **8** displays an x-ray **186**. As before, the healthcare provider may annotate the x-ray **186** with comments and observations by clicking on the annotate button **187**. The healthcare provider may likewise close the viewer window **185** by clicking on the close button **189**.

Certain additional structures in the point of care system **100** (FIG. **1**) will now be discussed with reference to FIGS. **9**, **10** and **11**. Referring now to FIG. **9**, an optional medication data capture **148** supplements the structure of the point of care system **100** of FIG. **4**. A medication data capture **148** allows a healthcare provider to monitor a patient's medications. The medication data capture **148** communicates with the patient data capture **140** to account for medications the patient is currently taking. The medication data capture **148** similarly communicates with the progress notes **144**, where a practitioner can monitor changes in a patient's condition resulting from medication therapies. Referring now to FIG. **10**, an optional practice guideline **149** supplements the structure of the point of care system of FIG. **4**. The practice guideline **149** provides references for practitioners to consult regarding courses of action to obtain a diagnosis and alternative treatments for various conditions. The practice guideline **149** communicates with the patient data capture **140**, the clinical data capture **142** and the encounter data capture **146** to assist the practitioner in selecting the appropriate course of action. The practice guideline **149** likewise communicates with the progress notes **144** to provide a healthcare provider with a historical context of the patient's condition and alternative treatments already attempted.

FIG. **11** shows a point of care system **100** having a medication data capture **148** and a practice guideline **149**. As before, the medication data capture **148** communicates with the patient data capture **140** and with the progress note **144**. Similarly, the practice guideline **149** communicates with patient data capture **140**, the clinical data capture **142**, the encounter data capture **146** and the progress note **144**. However, the practice guideline **149** may now communicate with the medication data capture **148** to address situations where accepted practice guidelines require a healthcare provider to prescribe and administer medications. In a preferred embodiment, the point of care system **100** includes the graphical user interface illustrated in FIG. **5**. Referring back to FIG. **5**, the patient chart window **150** includes tabs for medication data **191** and practice guidelines **193** that activate the medication data capture **148** and the practice guideline **149**, respectively. Similarly, pressing the medication manager button **192** activates the medication data capture **148** and the practice guideline **149**. A healthcare provider can enter, review and annotate patient medication data and practice guideline data as described previously.

Referring now to FIG. **12**, a block diagram illustrates the structure of the patient data repository **102**. The patient data repository **102** includes a patient locator **200**, a data manager **202** and a data interface **204**. The patient locator **200** generates a unique patient identifier (PID) **221** (FIG. **14**) for each patient and creates and maintains a table having PIDs for all patients who have data in the patient data repository **102**. All data records related to a patient **211**, **212**, **213**, **214**, **215**, **216**, **219** include and reference the patient's unique PID as shown in FIG. **13**.

With reference to FIG. **13**, upon creation of a patient record, the patient locator **200** creates a patient data structure **210** having the PID and the patient's name. In a preferred embodiment, the patient data structure **210** includes pointers to data structures having data within a patient record captured by the point of care system **100** and incorporated from external sources (e.g., a digital x-ray image file stored in a raster pixel format). Thus, the patient data structure **210** maintains a pointer to an interface files structure **211** having patient data transmitted from external sources. The patient data structure **210** likewise maintains pointers to a clinical data structure **212**, a progress note structure **213** and an encounter data structure **214**. These data structures include patient data captured by the clinical data capture **142**, progress notes **144** and encounter data capture **146**, respectively (FIG. **4**). In another preferred embodiment, the patient data structure **210** may include pointers to data structures having data generated by the reference database **104** and transferred by the legacy data system **106**. Thus, the patient data structure **210** may maintain pointers to a medication data structure **215** and a guideline data structure **216**. As described above, the medication **215** and guideline **216** data structures include patient data captured by the medication data capture **148** and the practice guideline **149**, respectively. In this embodiment, a reference data structure **217** may maintain pointers to the encounter data structure **214** and to the medication data structure **215** for access to reference information contained in a reference database **104**. Lastly, the patient data structure **210** may maintain a pointer to a legacy files structure **219** having patient data transmitted from the legacy data system **106**, such as an image of a patient chart.

FIG. **14** shows a logical view of a patient record **220** corresponding to the structure illustrated in FIG. **13**. The

patient record **220** includes the PID generated by the patient locator **200** (FIG. **12**) in the patient data repository **102** (FIG. **1**). In addition, the patient record **220** includes patient data in a variety of data types generated by healthcare providers. Thus, the patient record includes text data **223**, such as electronic mail and word processing documents from other healthcare providers, image data **225**, such as scanned physical documents, x-rays and CATSCANs, and audio data **227**, such as a physician's dictation and voice mail. Lastly, the patient record **220** has data tables **229**, such as a physician's ICD9 diagnosis codes and CPT procedure codes. In view of the structure of a patient record **220**, referring back to FIG. **12**, the data manager **202** uses the PID to store and retrieve patient records. Moreover, the data interface **204** permits communication with external sources to obtain patient data, such as demographic data, laboratory test results and x-ray images, and to transfer patient information, such as prescriptions for medication, from the patient data repository **102** to external healthcare providers.

With reference to FIG. **12**, the patient data repository **102** may optionally include a cache **206** for temporary storage of patient data and a data archive **208** for long term storage of patient data. In this embodiment, the data manager **202** coordinates the transfer of patient data to and from a data archive **208** into a cache **206**. For example, the data manager **202** may identify patient records that a healthcare provider needs for appointments scheduled at a future time and then transfer these patient records from the data archive **208** into the cache **206** for quick access prior to the scheduled appointment. Similarly, the data manager **202** may purge from the cache **206** records of patients who have not had recent appointments and whose records are already archived. The data manager **202** likewise tracks the location and description of patient data within the data archive **208** by associating the file name of the patient data within a patient record **220** with the patient identifier **221**. When possible, the data manager **202** will group data associated with a patient within the data archive **208** for rapid retrieval in a manner similar to files within a directory in an operating system. Thus, the data manager **202** assigns a directory to each patient identifier and then stores patient data within this directory.

FIG. **15***a* illustrates the process flow for the patient data repository **102** (FIG. **1**). For example, the point of care system **100** (FIG. **1**) issues a request for patient data **250**. With reference to FIGS. **15***a* and **12**, the patient locator **200** receives the request from the point of care system **100** and, at **251** attempts to find the PID for the record having the requested patient data. As determined at **252**, if no PID is found, the patient locator **200** reports an error **253**. At this point, the patient data repository **102** (FIG. **1**) may recover from the error **253** by either restarting the process or by ending the process. Otherwise, the patient locator **200** communicates the PID to the data manager **202**. The data manager **202** locates the patient record using the PID at **254**. As determined at **255**, in a system without cache **206** and without a data archive **208**, the data manager **202** delivers the requested data **256** to the point of care system **100**. In a system having a cache **206** and a data archive **208**, the data manager **202** determines at **257** if the requested data exists in the cache **206**. If so, the data manager **202** delivers the requested data **256** to the requester from the cache **206**. Otherwise, the data manager **202** first moves the data **258** from the data archive **208** to the cache **206** and then delivers the requested data **254** to the requester from the cache **206**.

In addition, FIG. **15***b*, in conjunction with FIG. **12**, illustrates the process for transferring data from a cache **206** to a data archive **208**. The data manager **202** monitors the contents of the cache **206**. To improve the performance of the cache **206**, the data manager **202** requests transfer **260** of data to the data archive **208** under certain conditions. For example, the data manager **202** may purge the cache **206** when data requested for storage in the cache would exceed its memory capacity. In this circumstance, the data manager **202** first transfers to the data archive **208** signed files and then data files in chronological order, i.e., oldest files first. Similarly, a healthcare provider can specify a predetermined time, such as 3 calendar days, or other selected conditions for transfer to the data archive **208**. As determined at **262**, if the cache **206** does not have the data to transfer, the process ends as the data manager **202** ignores the request. As determined at **264**, if the data in the cache **206** is not ready for transfer, the process ends and the data manager **202** queues the request for the next transfer of data to the data archive **208**. Data in the cache **206** is ready for transfer when a physician has reviewed and accepted it and when it has not been previously committed to the data archive **208**. Otherwise, the data manager **202** transfers data from the cache **206** to the data archive **208** at **266**.

Referring now to FIG. **16**, the data interface **204** of the patient data repository **102** includes an interface manager **270**, a data handler **272** and a communication interface **274**. To transfer and receive patient data from external sources (not shown), the interface manager **270** communicates with a data handler **272** and a communication interface **274**. In addition, the communication interface **274** communicates with the data handler **272** for conversion of received external patient data into formats recognized by the EMR system. The interface manager **270** creates and maintains an interface registry of data formats for external sources. Prior to data transfer or receipt by the EMR system, the interface manager **270** registers an interface for an external source. Upon registration of an interface, the interface manager **270** can provide the appropriate conversion routines for the data handler **272** to use for transfer of data to and receipt of data from an external source. These conversions are well understood by the relevant technologist.

FIGS. **17***a* and **17***b* illustrate the operation of the data interface **204** of the patient data repository **102** (FIG. **12**). Referring now to FIG. **17***a*, the data manager **202** issues a request **280** for patient data from an external source. At **282**, the interface manager **270** determines if the registry includes an interface for the external source, such as a laboratory or pharmacy. As determined at **282**, if the registry includes an interface for the external source, the communication interface **274** connects to the external source **284** to receive patient data. The data handler **272** retrieves the appropriate conversion routine for the external source to convert data **286**. In a preferred embodiment, the data handler **272** converts data from an external source into a database table for the appropriate PID. Lastly, the data manager **202** incorporates converted data **288** into the patient record. Otherwise, the interface manager **270** reports an error **289**. The data manager **202** may recover from the error **289** in several ways. First, the data manager **202** may invoke a module to register an interface for the external source so as to allow the process to continue. Second, the data manager **202** may end the process at this point. Lastly, the data manager **202** may restart the process in the event the external source was specified incorrectly.

Referring now to FIG. **17***b*, an external source requests data **290** from a patient record. As described above, the interface manager **270** determines at **292** if the registry includes an interface for the external source. As determined

at **292**, if the registry includes an interface for the external source, the data manager **202** locates the requested data at **294** and the data handler **272** converts requested data at **296** to the format required by the external source. The communication interface **274** then sends the converted data to the external source at **298**. For example, the patient data repository **102** may transmit a physician's prescription for medication to a hospital or pharmacy. If the registry includes no interface for the external source, the interface manager **270** reports an error **299**. Similarly, as discussed above for the process flow of FIG. **17***a*, the interface manager **270** may recover from the error **299** by restarting the process, ending the process or invoking a module to register the external source to allow the process to continue.

Referring now to FIG. **18**, a block diagram illustrates the structure of the optional reference database **104** (FIG. **1**). The reference database **104** includes a diagnosis module **300**, a medication manager **302** and a procedure module **304**. A healthcare provider can use the reference database **104** for assistance in diagnosing a patient's disease, prescribing medications and ordering supplemental procedures to treat the disease. The diagnosis module **300** communicates with a medication manager **302** to obtain information on medications indicated by a diagnosis. The medication manager **302** provides information on medications, such as proper dosages, allergies, contraindications, adverse interactions with other medications, and side effects. The diagnosis module **300** likewise communicates with a procedure module **304** to obtain information on the proper administration of procedures indicated by a diagnosis. The procedure module **304** provides information on procedures for treatment as indicated by the diagnosis. In many instances, the medication manager **302** communicates with the procedure module **304** regarding the administration of various medications.

In a preferred embodiment, the point of care system **100** provides access to the reference database **104** through a graphical user interface having a patient chart window **310** shown in FIG. **19**. A healthcare provider accesses the diagnosis module **300** and the procedure module **304** by pointing and clicking on a reference access button **312**.

As shown in FIG. **20**, the reference access button **312** produces a reference window **330** including the graphical interfaces for the diagnosis module **300** and the procedure module **304**. For example, to enter a diagnosis, a physician clicks on the scroll down button **331** adjacent to the system box **332** to produce a list of body systems. The physician selects the appropriate system and the diagnosis module **300** enters the selected system in the system box **332** and provides a list having specific diagnosis codes for the selected body system in the diagnosis box **334**. The physician then selects the appropriate diagnosis code and clicks on the add button **336** adjacent to the diagnosis selection box **337**. The diagnosis module **300** enters the selected diagnosis code to the diagnosis selection box **337**. The physician may repeat the above steps to add multiple diagnosis codes to the diagnosis selection box **337**. In a similar manner, a physician uses the scroll down button **331** adjacent to the topic box **333** to select the appropriate procedure topic. The procedure module **304** enters the selected procedure topic in the topic box **333** and provides a list of procedure codes in the procedure box **335**. The physician now selects the appropriate procedure code and adds it to the procedure selection box **338** by clicking on the add button **336** adjacent to the procedure selection box **338**. The physician may likewise repeat the above steps to add multiple procedure codes to the procedure selection box **338**. The physician completes entry of diagnoses and procedures by clicking on the done button **339** to return to the patient chart window **310** of FIG. **19**.

The healthcare provider similarly accesses the medication manager **302** (FIG. **18**) by clicking on a medication button **192** (FIG. **19**). Referring now to FIG. **21**, the medication button **314** activates a medication manager window **350**. The physician can review the patient's history by viewing the medication history box **351** and the diagnosis history box **352** before prescribing any new medications. The physician can also review any patient allergies in the allergy box **353**. The physician can select a medication by entering the name of the medication in the name box **354**. Note that as the physician enters the root letters of a medication name, a list of medications with the root letters appears in the medication list box **355**. As before, the physician selects a medication from the list by clicking on it and the medication manager **302** places the selected medication in a selection box **356**. If there are no contraindications or allergies for the patient, the physician prescribes the medications listed in the selection box **356** by clicking on the prescribe button **357**.

Otherwise, if a contraindication exists, a warning appears in a warning bar **358** to alert the physician. In view of the warning, the physician can investigate the effects of the medication by clicking on the results button **359**. Referring now to FIG. **22**, the results button produces a medication interaction window **361**. A medication selection box **362** displays the medications selected and under consideration by the physician. An allergy list box **363** displays the patient's allergens. Folder tabs **364** include labels describing the medication combinations and interactions. The physician clicks on one of these folder tabs **364** to display the contents of the folder in the viewing box **365**. The physician can then evaluate the information on the interaction including potential adverse patient reactions. The physician clicks on the done button **366** to return to the medication manager window **350** of FIG. **21**. The physician can make any needed revisions to the medications selected in the manner described above. Afterwards, the physician exits the medication manager **302** by clicking on the exit button **360**.

Referring now to FIG. **23**, a block diagram illustrates the structure of the optional legacy data system **106** as shown in FIG. **1**. The legacy data system **106** includes a data source **370** and a converter **372**. The data source **370** comprises physical data **374**, such as paper based records and photographs, and electronic mainframe data **376**. The converter **372** receives information from the data source **370** and transforms the information into an electronic format compatible with the EMR system. For example, to input physical data **374**, such as paper or image based data, into a patient record, the converter **372** comprises a scanner to digitize the physical data into a binary file format for incorporation into the patient's record. To input electronic mainframe data **376**, the converter **372** employs the same mechanism used for transfer or receipt of patient data from external sources. As described before, the converter **372** determines if an interface exists for the mainframe data, selects the appropriate data handler and converts the data into the proper format for incorporation into a patient record.

II. EMR System Configurations

FIG. **24** illustrates one possible configuration for the EMR system of the present invention. The system comprises a wide area network (WAN) **402**, the World Wide Web (Web) **404** portion of the Internet, and remote web servers **406**, **408**, **410** communicating with web browsers **412**. The WAN **402** comprises a plurality of local area network (LAN) servers supporting local and remotely located healthcare providers. For example, the WAN **402** includes LANs sup-

porting Scripps Health **414** and Sharp Memorial **430** in San Diego and Cedars Sinai **432** and Loma Linda **434** in Los Angeles, Calif. In one presently preferred embodiment, the server comprises a multi-processor personal computer having Intel Pentium processors, such as a Compaq Proliant 4500R 5/100 Model 2, communicating with a fault tolerant, error correcting storage device, such as a Hewlett Packard 20XT Optical Jukebox having 20 gigabytes of storage capacity. The LAN **400** includes a backup server **426** and several peripherals, such as a scanner **424** to input documents and a laser printer **422** to print out documents. In a preferred embodiment, the LAN backbone comprises an Ethernet twisted pair cable configured in a general star topology. Similarly, the scanner **424** comprises a Fujitsu M3093EX scanner using Kofax KIPP ImageControls software and the laser printer **422** comprises a Hewlett Packard LaserJet 4Plus. Healthcare providers may access the LAN **400** using a desktop computer **416**, a laptop computer **418** or wireless pen computer **420**. In a preferred embodiment, the desktop computer **416** comprises a Compaq Deskpro 5/75 Model 630, the laptop computer **418** comprises a IBM ThinkPad 760CD and the pen computer **420** comprises a Fujitsu Stylist 1000 configured with a Solectek AirLAN PCMCIA network adapter for wireless LAN access. The EMR system also provides for communication through the World Wide Web. For example, remote healthcare providers may access the WAN **402** on the Web using the domain name "www.westcst.com" **436**. Thus, a healthcare provider located in Boston, Mass. may access a patient record resident on the Scripps Health server **414**, located in San Diego, Calif., using a web browser **412**, such as Microsoft Explorer or Netscape Navigator, communicating with a Web server in Boston, Mass. having the domain name "www.boston.com" **406**.

In a preferred embodiment, servers **414**, **426**, desktop **416**, or laptop **418** computers and peripherals, such as printers **422** or scanners **424**, communicate with each other and with the Web using a network operating system, such as Microsoft Windows NT, Windows 95 or Windows for Workgroups. Similarly, pen computers **420** use the Microsoft Windows for Pen Computing operating system. In another preferred embodiment, the servers, computers and peripherals communicate using an operating system supporting Web browsers on computer networks, such as Unix, Novell Netware or Apple System 7.0. In yet another preferred embodiment, the EMR system includes servers, computers and peripherals networked using mixed network operating systems, such as Unix, Netware and Windows. For example, the LAN **400** may operate on a Windows NT network operating system, whereas the LAN **430** may operate on an Apple System 7.0 network, and the Web server "www.boston.com" **406** may operate on a Unix operating system. Thus, the EMR system supports communication among a variety of hardware components, such as printers **422**, scanners **424** and pen computers **420**, using a variety of network operating systems, such as Windows, Netware or Unix. In a preferred embodiment, healthcare providers, such as clinics and laboratories, may also communicate with the EMR system using modem links and standard v0.34 modem devices, such as a US Robotics Sportster 28,800 modem.

The EMR system includes several databases of electronic information, such as the medication manager **302** and the data manager **202**. In a preferred embodiment, the EMR system implements a relational database language that conforms to American National Standards Institute (ANSI) standard SQL-92, a 580 page specification for the SQL relational database language. A database language standard specifies the semantics of various components of database management systems (DBMS). In particular, it defines the structures and operations of a data model implemented by the DBMS, as well as other components that support data definition, data access, security, programming language interface and data administration. The SQL-92 standard specifies data definition, data manipulation, and other associated facilities of a DBMS that supports the relational data model. SQL is old in the art and additional information on SQL-92 is available in ANSI specification X3.135-1992, hereby incorporated by reference.

Similarly, in another preferred embodiment, relational databases in the EMR system support the Open Database Connectivity (ODBC) model. ODBC is an application program interface (API) that allows client applications running under Microsoft Windows to access data from a variety of data sources, including relational and non-relational DBMS. These data sources may reside on a client machine or they may be located on a remote server communicating through a network common to the client machine. Under ODBC, data sources may vary in complexity from shrink-wrap databases, such as Microsoft Access, running under Windows on a client machine to more sophisticated, proprietary relational DBMS running on a Unix server or mainframe computer. For a client application to access data from a data source, a dynamic link library (DLL) driver must exist for each data source to be accessed. For additional information on ODBC is available from Inside ODBC, by Karl Geiger, hereby incorporated by reference.

II. Summary

The electronic medical record system of the present invention advantageously overcomes several limitations of existing technologies and alternatives. Because it is more efficient and cost effective to move data, instead of physical records and healthcare providers, the present invention eliminates the need to create and maintain any physical data records. In contrast to other systems, the present invention creates and maintains all patient data electronically. Thus, there is no need to find, pull, move, update, file and replace physical charts. As a result, healthcare providers no longer require substantial shelving and storage space for physical files. The present invention likewise eliminates the mishandling, loss and destruction of patient data typically associated with maintenance of physical data records.

Using the present invention, healthcare providers enter patient data immediately at the point of care. Thus, the EMR system captures each piece of data at its source at the time of entry, including time and healthcare provider identification. The EMR system thus provides a complete audit trail for all patient data. The audit trail, in turn, permits inexpensive analysis of outcomes, utilization and compliance. For example, outcomes typically refer to the effectiveness of a treatment plan. Thus, the EMR system enables a healthcare provider to analyze patient recovery times and incurred costs to measure the efficacy of the treatment plan. Similarly, utilization typically refers to how well available resources are utilizing time. Thus, the EMR system provides the capability to analyze utilization of physicians, nurses, staff and equipment as well as time utilization for patients, such as wait times for referrals, lab results and physician examinations. Lastly, compliance typically refers to conformance with government and accreditation standards and regulations. The EMR system provides tools to enable healthcare providers to measure conformance to standards and regulations. To facilitate entry of patient data at the point of care, the invention provides touch screens for entry of lab orders, medications, diagnoses and procedures. The invention like-

wise provides instant access to a patient's electronic medical record by authorized healthcare providers from any geographical location. Thus, the EMR system enables authorized healthcare providers to access and update patient files using wireless pen-based personal computers. In addition, authorized healthcare providers can access a record while other healthcare providers use the same record. By providing simultaneous access to patient data, the present invention enables real-time collaboration among multiple healthcare providers.

The availability of electronic data permits instant, sophisticated analysis of a patient's clinical data. Thus, the EMR system can create graphs of a patient's vital signs and lab results or the system can provide an analyze patient information to identify medication interactions and allergies. Using the present invention, a healthcare provider can likewise select, sort, and analyze patient data to identify relationships among the data considered. In addition, the EMR system provides flexibility in the creation and maintenance of patient data repositories. Thus, the present invention can support a large healthcare enterprise distributed across a large geography as well as a single physician office. Moreover, the present invention ensures patient confidentiality through the use of a tiered password system. The EMR system provides several levels of security for access to patient data. For example, a system administrator may have global password access to any patient data for system maintenance and debug purposes, whereas physicians may have access only to patient records within their specialty and nurses and staff may have access to only those patient records within their immediate care. In addition, a patient may request restricted access to their data by only certain personnel. Thus, in contrast to physical records, the EMR system provides superior protection of patient data.

In addition, the present invention is useful in legal, manufacturing and general administration environments. For example, the present invention is capable of organizing, maintaining and protecting legal files in an attorney's office. Thus, the EMR system can store and retrieve scanned images of paper documents, such as deeds and assignments, as well as other native file formats, such as word processing files. The EMR system organizes and retrieves this data in a manner akin to that of a patient's medical record. Upon entry of a client data into the EMR system, attorneys can annotate documents, transfer information to and from other systems, or create new data for automatic filing in the client or case file. Similarly, the EMR system is useful for management of procurement or regulatory data in a manufacturing context. Thus, the EMR system can organize and maintain material safety data sheets (MSDS) as well as other data pertinent to materials procurement, such as conformance to specification measurements and inspection data for received lots, in a manufacturing environment. Lastly, the EMR system is useful for general administrative files in any organization. For example, the present invention is applicable to employee files in human resources, customer files in sales and approved suppliers in procurement. The EMR system can organize and retrieve data within these files in the manner as patient data in a patient data record. As discussed above, upon entry of a data into the EMR system, users can annotate documents, transfer information to and from other systems, or create new data for automatic filing in the respective file.

Those skilled in the art may practice the principles of the present invention in other specific forms without departing from its spirit or essential characteristics. Accordingly, the disclosed embodiments of the invention are merely illustrative and do not serve to limit the scope of the invention set forth in the following claims.

What is claimed is:

1. A medical records system, comprising:

a point of care system to capture patient data at a point of care; and

a patient data repository, in communication with the point of care system and with external systems, to store and organize the patient data for access by the point of care system.

* * * * *